Expert and Government Review Comments on the IPCC WGIII AR5 Second Order Draft – Technical Summary

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19964	TS					Figure 3 a-b. I would include all GHG emissions here. This information is available in the literature. The inclusion of non-CO2 gases and LULUCF sources makes a major difference in the outcome. There is no analytical basis to exclude any gases or sources, incl. LULUCF. Please check, and present the numbers including all sources and gases	Accepted. We added LULUCF. Over very long time horizons it is problematic to represent CH4 and N2O in terms of GWP-100.
19965	TS					The results would be much more policy relevant If the results would be presented for all GHG emissisons. In this way also reductions for all GHG emissions compared to 2010 levels could be presented for different years (2030, 2050)	Accepted.
19966	TS					Very nice figure! Please explain if CO2 emissions include land-use. I would start in 2005 for all three figures. I would also include a figure of all GHG emissions, at least for the upper figure. This could be included upper right. Please reword optimal policy response. Please use one terminology for the cost-effective pathways. Now in the text it is mentioned as cost-effective and in figure cost-optimal. Please improve the last sentence of the legend, as not clear.	Noted. The figures has been considerably revised taking into account comprehensive feedback from the review.
19967	TS					Does the upper figure presents the full range? Could you be more precise on how many scenarios do underly the delayed pwathways. I would also indicate in Table 6.2 and Figure 6.7 the number of scenarios underlying these delayed and optimal pathways.	Noted. The figures has been considerably revised taking into account comprehensive feedback from the review.
19968	TS					The pledges are introduced very briefly in CHapter 6, and definitly needs more text to explain. For example, what is the reason for the range of outcomes, is this due to the comibination of assumptions around conditionality of the pledges, accounting rules for double counting, surplus emission units or land use credits (as in most of the pledges studies, and in the UNEP gap reports), or is it because of the different models. The range is normally as high as the BAU emission levels, so this range presented here seems rather low. The range is norrmally also presented for all GHG emissions. This is extensively explained in Chapter 13. I would make more cross references to Chapter 13. The numbers presented here on the emission levels resulting from the pledges, also needs to be consistent with the numbers presented in Chapter 13. In Chapter 13 it is based on many model studies published in journals (like Nature), and also in a series of UNEP gap reports, whereas here, the authors refer to a AMPERE protocol. For many readers it is unclear how these emissions range from the pledges are being calculated, except for the persons involved in the AMPERE project. I would recommend the authors present a range (preferable based on CO2-equivalent emissions) using the Chapter 13 information, as this Chapter extensively described these pledges, and also present the very detailed studies underlying these ranges.	Noted. The figure has been removed from the draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32576	TS					The deployment if Integrated Food-Energy Systems (IFES) could be mentioned. General of IFES: Energy diversification will tend to replace fossil fuels with renewable forms of energy, but in the case of bioenergy, will only reduce net GHG emissions subject to use of good practices. Specific: Excessive use of agriculture and forestry residues for bioenergy can compete with their role in returning carbon to the soil; different bioenergy technologies lead to different levels of nutrient availability in the soil. (negative) Indirect effects of biofuel demand such as indirect land-use change and price-induced intensification can lead to net GHG increases. (negative) The use of residues for bioenergy rather than for animal feed could act as an additional source of displacement and potential land-use change. (negative) Further, access to energy can improve resilience: availability of energy for productive use (both for primary production and value-adding processing) and reduction of food losses (e.g. through improved processing, packaging and storage) can enable improved use of natural resources and increased productivity and profits. Provision of modern energy services through renewable forms of energy is likely to lead to sustainable increases in productivity and income (particularly where locally produced), whereas if fossil fuels are used there could be productivity and income benefits along with negative environmental consequences. Trade-offs need to be assessed in the local context and taken into account. But more affordable energy services may be less energy efficient (e.g. cheaper tractors may be less efficient). Also being more energy efficient can have a socio-economic benefit. General: Savings in energy costs will result in increased income available to enhance adaptive capacity Decreased dependence on energy inputs (especially fossil fuels) will tend to reduce vulnerability to shocks in energy prices Some “climate-proof” agricultural production and energy systems may result in lower energy efficiency (negative) Specific: Practices such as conservation agriculture that enhance crop cover, soil water retention and soil organic matter may increase resilience to drought and extreme weather events Irrigation tends to enhance resilience and may increase energy efficiency through its impacts on productivity Please get in touch. At FAO we did quite a lot of work on energy-climate trade offs on the environmental, social and economic pillars of sustainability.	Accepted. Table has been revised
32069	TS					In yhe annex of the table should be changed the cuban position and take as References for these changes the following literature: References to these material may be seek in: http://www.cubadebate.cu/noticias/2011/05/09/descargue-en-cubadebate-los-lineamientos-de-la-politica-economica-y-social-pdf/ ; http://www.cepal.org/cgi-bin/getprod.asp?xml=/ccas/noticias/paginas/6/49316/P49316.xml&xsl=/ccas/tpl/p18f.xsl&base=/ccas/tpl/top-bottom.xsl; and www.one.cu/.../energiarenovables/inventarionacional2011.pdf	Comment unclear.
31164	TS					EIT (Reforming Economies/Economies in Transition) defined in the caption is not in the actual figures; should this be REF, to correspond with label in graph, and with abbreviation used in TS.5 (p. 10)?	Accepted.
32602	TS					See my comment on this Table in the SPM, and in Chapter 15.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22908	TS					comment needed regarding timing and uncertainty ch2 p43 is base	Rejected. It is unclear what to which part of the text the reviewer is referring to.
22910	TS					Insert a paragraph that there is a heated debate over the renewable energy diffusion by subsidies - regarding costs, environemntal effectiviness, intermittency and associated back up costs. See Frondel (2010) for example.	Taken into account - text revised.
19635	TS					lacks reference in the text.	Accepted.
32726	TS					The justification for the strong focus on bioenergy production in this section is lacking, in particular because this mitigation option seems to have so many drawbacks. The deliberations in this section may be better spent on more promising options.	Noted. Bioenergy is an important component many transformation pathways projected by integrated assessment models, so the implications of bioenergy need to be dealt with when discussing land use
19505	TS					I do not agree that Global Cost Potential is an appropriate metric for aggregating GHGs in most contexts. In particular, it could create distoritions under a cap-and-trade program. What if new technology changes relative abatement costs of different GHGs in the future?	Noted - text revised.
19507	TS					The section on macroeconomic mitigation costs is confusing and not reflective of the discussion in Ch. 3. It is strange to criticize cost estimates on the basis that they do not reflect the benefits or co-benefits of mitigation--it is important not to conflate costs and benefits.	Accepted - text revised.
19720	TS					Technical Summary report is of significance in its own right. Some readers will study only this document. So, it would be necessary to include a separate paragraph devoted to geo-engineering options. Definition of SRM and CDR should be done. It should be underlined that geo-engineering don’t have to substitute measures of mitigation. Geo-engineering aims to avoid climatic crisis if mitigation measures will be insufficient for climate stabilization on accepted level.	Accepted. Findings on geoengineering are included.
23378	TS					Analysis of GHG emission trends and drivers should take into accout the global urbanization trends, particularly the prospect of GHG emissions in developing countries that are rapidly urbanizing. World Bank's 2010 Report (see, The World Bank. Cities and Climate Change: An Urgent Agenda. 2010) specifically discusses the double challenges of climate change and urbanization, particularly on developing countries, which are both rapidly urbanizing (hence more GHG emissions) and most vulnerable to climate change. In fact, the difference betweend developed and developing coutnries goes beyond the comparison of total GHG emissions and per capita emissions. More in-depth analysis is necessary to understand different prospects and driving forces of GHG emissions in developed and developing countries. Developing countries' climate change mitigation is constrained by its urbanization trend, need for poverty reduction (another important pillar for sustainable development), as well as the lack of sufficient funding for development and mitigation.	Accepted. Urbanization is discussed in depth in chapter 12. In the discussion on emission drivers, this is treated now.
23379	TS					Policy recommendations and solutions have not sufficiently differentiated the situations faced by developed and developing countries. Because of different stages of urbanization they are in, developed countries and developing countries face different challenges, and need to adopt different mitigation strategies for climate change. For instance, the report (including the technical summary) has emphasized technological solutions to climate change mitigation problems, which may turn out to be expensive for developing countries. Moreover, considering the rapid urban construction and spatial re-organization that is bound to happen in the next two decades in most developing countries, simlying relying on adopting new technology is very likely to be offset by rising travel and residential demands due to failed urban planning strategies.	Taken into account - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
31163	TS		21		25	glad to see the broader scope of mitigation as part of array of sustainable development goals- should results in much more productive change! The clearer this message can be made throughout AR5, the better	Accepted - text revised.
27284	TS					Section SPM.2 presents emission trends and drivers that are largely related to economic criteria. Such analysis by the IPCC must also take into account social indicators and present social development criteria as basis for comparison of emissions among regions and groupings.	Rejected. The focus here is on summarizing the understanding of what is driving emissions. It is very factual. There is no agreement in the literature on what information is adequate to compare emissions across countries. It was decided to focus solely on emission trends and their drivers - also due to the space constrains.
20034	TS					Insert "Table 6.1" of chapter 6 (p.19 line 7-18) somewhere appropriate to explain categorization of the scenarios.	Accepted. A similar table has been added to the TS.
34743	TS					Why renewables come only after replacing coal with gas, and CCS? It gives the impression of order of importance. This is odd, given how promising the prospects for renewables, in particular, look right now.	Accepted - sequence now is revised.
30229	TS					[related to my comment on Section 6.4] In view of the dichotomy of weak near-term climate policies vs the general agreement among negotiators on the 2°C stabilization as long-term climate target, the implications of delayed or fragmented near-term climate policies on the achievability of long-term targets is likely to be one of the most policy relevant outcomes the AR5. Currently, the last paragraph of Section TS3.3. deals with this topic. Related emissions pathways are also discussed on p. 16 (TS3.2). Given the importance of this topic, it would be desirable to have a longer dedicated section of the TS addressing the implications of weak near term climate policies on the achievability of long-term stabilization targets, and related mitigation requirements.	Accepted. However, we are framing this slightly differently in the final draft of the TS/SPM: 2030 emission levels strongly determine subsequent tansition dynamics - particularly between 2030 and 2050. We do not care too much what causes these 2030 levels. Delays in sufficiently strong action is certainly one of thh causes.
25561	TS	0				Please use the word of "stabilization" carefully. Many scenarios particularly in lower levels of concentration, e.g., Categories 1-3 in Table 6.1, include overshoot scenarios of concentration or/and temperature. Please distinguish the "450 ppm CO2eq stabilization" and "450 ppm CO2eq in 2100", for example.	Noted.
25562	TS	0				Please insert Tables 6.1 and 6.2 of Chapter 6 into the TS because these figures are very important and help us to understand the scenarios which have already been depicted in the TS.	Accepted. A table similar to Table 6.1 has been incorproated in SPM and TS.
23507	TS	0				Comments made on the SPM chapter apply in the same way to identical sections of this summary	Rejected. We cannot easily merge these comments. The author team did what it could, but this cannot be guaranteed. However, changes in the SPM are carried over to the TS for consistency.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30672	TS	0				There is virtually no discussion in the TS (or elsewhere in the WGIII report) about the new scenario process, which is surprising as these were expected to inform the AR5. A brief mention of the new process, and a status report, would be helpful to governments.	Accepted. There are many new scenarios published within the AR5 cycle with different underlying socio-economic dynamics. These are discussed in the context of baseline scenarios. The shared socio-economic pathwaysw (SSPs) as envisioned in the new scenario process did not arrive in time. This will be carefully explained in a box.
30673	TS	0				The quality of the Figures in the TS are generally poor. Readability was negatively impacted by very small font sizes, complicated Figures, insufficient supporting captions and other factors.	Accepted. All figures have been improved, many were replaced with a view of them being understandable to the reader.
30674	TS	0				There are repeated references to "transformation pathways / scenarios". This term needs defining/explaining in the TS.	Noted.
30675	TS	0				In a number of places, there is reference to Developed and Developing Countries while the accompanying Figures use alternate descriptors. Consistency would be helpful.	Accepted.
30676	TS	0				It is difficult for readers to understand why some bolded sentences have confidence statements while others do not. It would help readers interpret information in this Summary if an explanation were provided.	Rejected. This is clearly identified in the uncertainty guidance.
30677	TS	0				There is very little information assessing the technical and economic potential (and risks) of geoengineering. This was supposed to be covered primarily in Chapter 5 of the WGIII report according to the outline approved by the Panel and yet the only reference to geoengineering in the TS is to Ch. 13 on international cooperation. It would be helpful if the reasons for this gap could be clarified. If a comprehensive assessment of geoengineering options was beyond the scope of the WGIII mandate this should be made clear. If a lack of literature is the reason, this should be made clear.	Accepted. Findings on geoengineering were added. Note that technical and economic potential cannot be easily assessed in this emerging literature.
30678	TS	0				There is very little information on the feasibility of wide scale implementation of carbon capture and storage, in particular in combination with bioenegy (BECCS). Since the TS does make repeated reference to many mitigation scenarios requiring negative GHG emissions to achieve low atmospheric GHG stabilization levels and notes that this could be accomplished through the use of BECCS, some additional information from the assessment of BECCS would be useful.	Noted.
32597	TS	0				A number of points to TS flow from comments on SPM and individualc hapters. I wonder if the SPM could be a vehicle for trying to resolve some of the problems around "cross cutting issues" - it doesnt really seem to play this role at present. Also in reading through, I felt there was one underlying issue that the TS rather severely confuses theories and models with reality. After trends, it seems to lead on models and theory; all the empirical grounding in sectoral realities comes later. This feels the wrong way round. Surely the TS provides an opportunity to work through the evidence in some depth, and then consider how well theories represent, and models interpret and aggregate, this evidence to draw conclusions, and also to be able to identify and express caveats?	Noted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32598	TS	0				Correspondingly, it might help to be honest up front about some of the limitations of the global optimisation models. Most do not have any direct representation of economic growth determinants. They assume economies are fully employed in all cases (operating at the frontier). Most assume perfect foresight over long periods. Most are purely or predominantly "Second domain" in their structural assumptions, without explicit representation of co-benefits, fossil fuels subsidies, energy efficiency barriers, behavioural or other 1st domain opportunites. Representation of innovation, institutions and infrastructure (3rd domain) tends to be exogenous or only weakly endogenous. Most fundamentally, innovation is widely recognised to be very important but we retain deep uncertainty about how to parametise innovation or even represent conceptually Shumpeterian processes of creative destruction. Nor do the models represent voltaility or instability in global fossil fuel markets. Etc etc. Surely the intergovernmental coommunity (and the IPCC) would be best served by acknowledging such limitations ?	Noted
21427	TS	0				The description of emission trends and drivers is not a balanced view or based on the knowledge presented in the underlying report. The description here gives the same status to estimates based on consumption approaches as to those based on inventories without acknowledging the sensitivity to the choice of methodologies for producing consumption-based estimates, and that less research has been done on consumption approaches (TS.2.2, p.7 and 9, and also in SPM). It also attributes a level of "high confidence" to the statement "Developing countries tend to be net exporters of CO2 emissions while developed countries tend to be net importers of emissions" even though this message is obviously highly dependent on aggregating countries in these two blocks, and not reasoning by regions or any other way. This statement does not reflect the regional numbers in Fig. TS.2 (see especially economies in transition and the Asia region).	Rejected. We believe that this finding is robust as there is evidence from different datasets.
21428	TS	0				In general, similar as in the SPM, the technology chapters seems at good shape and many important details are given, whereas the policy chapters 13 to 16 lack some concrete conclusions. Especially an ex-post evaluation of policy instruments, e.g. of the ETS in EU or renewable supporting schemes is missing. There is a clear imbalance and tension between these two parts. As in the next years much more effort has to be put on implementation (rather than on long-term projections) I clearly see here a deficit.	Noted. The policy section has been largely re-drafted.
21429	TS	0				The TS needs to include a explanation of how the RCPs, ppm and temperature are related. A box for this would be highly recommended, although part of this is based on WG1, but you could use this information as the report will be published then anyway. We think it is not sufficient to hint that it will be done in the SYR.	Accepted. This is covered in a new table, which is included in the new TS.3.1
21430	TS	0				Findings relating to co-benefits of climate policies are downplayed or misrepresented. See specific comments on TS.3.2 and TS.4.8.	Noted.
22829	TS	0				in general it would be good to have a mapping of RCPs, ppm and temperature, a box for this would be highly recommended although part of this is based on WG1, but you could use this information as the report will be published then anyway. I think it is no way out to give a hint to the SYR.	Accepted. This is covered in a new table, which is included in the new TS.3.1
22841	TS	0				In general, similar as in the SPM, the technology chapters seems at good shape and many important details are given, whereas the policy chapters #13-16 lack some concrete conclusions. Especially an ex-post evaluation of policy instruments, e.g. of the ETS in EU or renewable supporting schemes is missing. There is a clear imbalance and tension between these two parts. As in the next years much more effort has to be put on implementation (rather than on long-term projections) I clearly see here a deficit.	Noted. The policy section has been largely re-drafted.
22844	TS	0				I am missing a section such as "from models results and scenarios to implementation". The whole scenario analysis is disentangled from the policy analysis. What would be needed to make the scenarios happen and put it into place? This is what governments want to know.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22845	TS	0				I very much like the idea with the boxes. But you only have them at the beginning, but also some boxes on the policy chapters would be nice. One could e.g. be on ETS, another could be on the experience with renewable supporting schemes (e.g. taken as a summary from the SRREN)	Noted.
22848	TS	0				From the scenario analysis in chp 6 it is clear that energy efficiency is very important. But I am missing an analysis of energy efficiency policies how to implement this (or I missed it).	Noted
34718	TS	0				The structure of the SPM is somewhat more logical than that of the TS. Maybe something to consider for the TS.	Rejected. The structures largely mirror each other with some more detail in the TS.
34719	TS	0				The TS and SPM need to make it easier for policymakers to understand how the timing of global peak and decline in emissions will affect availability of choices in the future; annual reduction rates required thereafter and their feasibility; the extent to which we will have to rely on technologies that don't yet excist in commercial scale and the sustainability and feasibility of which is questionable in light of other societal goals; and the risks of exceeding key thresholds with irreversible impacts. There should be a text box in the TS that discusses the timing of global peak and decline in emissions. This will be a key debate in the upcoming UNFCCC negotiations.	Accepted. The idea how different emission levels in 2030 are
34720	TS	0				The crucial role of energy savings and energy efficiency in achieving any mitigation goals is recognised in the sectoral assessment chapters (for buildings and transport in particular) and in the related sections in the TS, but its role doesn't seem to get fully acknowledged in the context of overall transformation pathways. As a consequence, a key message seems to get lost, about how carbon pricing alone will never be enough to incentivise materialisation of the energy savings potential.	Noted.
34721	TS	0				Considering that the faster-than-expected growth of renewables globally and their faster-than-expected costs reductions (especially for solar and wind) have been the most promising developments in the field of mitigation / low-carbon development since AR4, one would expect these developments to be better acknowledged in the technical summary, for example with concrete figures or a text box dedicated to indicators that would give the reader a sense of the scale and speed of the capacity additions, cost reductions and investment growth numbers experienced in recent years. This merits further consideration.	Noted.
39004	TS	0				Emissions of non-CO2 gases are not properly characterized to show their shares in total GHG emissions and explain trend and drivers. These gases contribute to a significant share and play an important role in mitigation policy discussions.	Accepted. Many figures focussed on fossil fuel related CO2 emissions in the second order draft. In this new draft the writing team made sure that the representation of gases is as comprehensive as possible.
39005	TS	0				Why isn't there more discussion of the relationship between population growth and emissions growth? This subject receives prominent treatment in full report, but appears to be neglected in the summary. Figure 5.3.4 and Figure 5.3.5 would be useful figures to include in the summary. Given the importance of the link between population growth in Asia and emissions increases, this relationship should not be omitted from the TS.	Rejected. Population is beside per capita GDP growth presented as one of the major emission drivers in the Technical Summary.
39006	TS	0				The most useful portions of Chapter 2 have not been presented within the summary. For this document the discussion in Chapter 2 related to the design and assessment of policy and programs under uncertainty is highly relevant and should be highlighted. A discussion that highlights the relative utility of the decision frameworks given the level of uncertainty associated with the problem of climate change as discussed in section 2.3 is warranted in the summary.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39007	TS	0				The WG3 report (and the TS) presents a number of framings for how you can look at emissions - on a regional, historic, cumulative basis, etc. What is lacking, however, is a presentation of how much embedded carbon exists in existing capital stock, so-called "infrastructure lock-in". One could argue that emissions prior to ~1990 (when the UNFCCC was established) should be weighted less because the world did not know that GHG emissions were harmful. Now, the world knows and those who continue to invest heavily in C-intensive infrastructure do so with the full knowledge of the ramifications. An excellent article to cite in this respect would be Davis, Caldeira and Matthews, Science, 329, 10 Sep 2010, p. 1330-1333.	Rejected. The specific contribution by Davis et al (2010) is interesting and therefore treated in the report. The author team decided not to highlight this in the summaries. The issue of lock-in is an important one and dealt with in Section TS.3.
39008	TS	0				In a great deal of the text "responsibility" is established and appears to be based on historical emissions and predate any agreements to address climate change. Therefore, the dates at which responsibilty is assigned should not be pre-1990. This in particular should be modified for Figure TS.3 and Figures SPM.3 and SPM.4. In part b of TS.3, the time bins should be 1750-1990, 1990-2010, and then 2010 (or most recent data). There are 2 figures(TS.3 and TS.4) and (SPM.3 and SPM.4) that pertain to consumption and production, only 1 figure is needed and there is no figure that reflects sector distributions and emissions (eg, Figure 1.3 should be drawn forward to the TS and SPM). If one of these figures must be kept at all, we propose to use Figure TS.4 instead of Figure TS.3 - once the revisions we suggest in our other comments are made.	Rejected. The TS does not talk about responsibility. It takes an accounting perspective. In other discussions emissions in the past have been proposed as one criterion for assigning responsibility to countries, but chapter 3, 4 and 6 are very clear that this discussion is not broader. It would be inappropriate to interpret any of the historic emission figures in terms of responsibility.
39009	TS	0				Classification of regions and countries: Throughout the TS (TS), regions of the world and countries are classified and grouped differently. For example, figure TS.1 uses G20, IC, DC, LDC and other groupings while figure TS.2 uses OECD90, EIT, LAM, MAF, etc. There are also reference made to Annex B, Annex I and Annex II countries. I recognize these classifications are made in the context of the particular topic being discussed in the underlying chapter, but it become confusing when they are pulled together in the TS. A box or table defining each classification should be included, rather than requiring the reader to go back to the underlying chapters.	Noted. We have added references to Annex X of the report, where the classifications are outlines. In general, authors decided that the choice of classification depends on question under consideration.
39010	TS	0				Acronym definitions: Please ensure that acronyms are defined at least once in the TS. For example, LULUCF, REF, RCP, CDM, etc.	Accepted.
39011	TS	0				Figures: The figures are lifted from individual chapters. As they stand in the TS, the figures are packed with information. Without the context and the detailed discussion, they are hard to follow and do not effectively convey the information intended. Some figures have errors or are not properly labeled or explained, which cause confusion. The authors should take a hard look at the figures, consider the key messages the figures are intended to present, and think about ways to make the figures straightforward and self explanatory. The authors should also think about ways to simplify the complex scientific graphs to make the graphs more user friendly. This may require modifications to graphs in the chapters, or creation of new graphs in the chapter summary that can be used in the TS.	Accepted. All figures were carefully considered and many changed since the Second Order Draft.
39012	TS	0				Figures: the titles of the figures should be clear, specific and self explanatory.	Accepted.
39013	TS	0				The figures should have clear legends and the figure text should have sufficient information on the acronyms and information presented in the figures.	Accepted.
39014	TS	0				The figure text is long in some cases and should be shorterned while being concise.	Accepted.
39015	TS	0				Figures should be crossed-checked for labeling and naming convention (for example, there are "REF" and "EIT" referring to economies in transition in different graphs).	Accepted.
39016	TS	0				Figures should be properly sized to ensure readability. This is especially so in figures TS.5, 10,12,13, 17,19, and 20.	Accepted.
39017	TS	0				Figures should be referenced in the text and placed properly following the reference.	Accepted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39018	TS	0				The TS needs a thorough cleanup to streamline the discussions. The current version reflects key points from individual chapters, and in some cases discussions of a similar issue appear in multiple places (e.g., institutional arrangement) and they can be either repetitive or inconsistent. The TS should be one cohesive document. The individual chapters should also be cross-checked and streamlined, and in some cases discussions should be reorganized, consolidated and streamlined, to ensure that the WGIII Report is a cohesive report.	Noted.
39019	TS	0				Discussions of institutional requirements/options appear in multiple sections (TS.3.4 and TS.5). The issues of institutional arrangements for meeting stabilization targets are interlinked with institutional issues and implementation possibilities at international, national and subnational levels as discussed in TS.5. The authors should consider to integrate and streamline the discussions of these two sections.	Noted.
39020	TS	0				This document aims to provide balanced information on the state of knowledge on the social and economic considerations of climate mitigation, as well as the technological solutions and institutional arrangements required to mitigate the impacts and risks of climate change. After reading the document, the readers are still left hanging on what can be done to achieve the goals. The last section of the document can leave a stronger note on what could be accomplished at the various decisionmaking levels.	Accepted. Particular consideration has been given to the re-darfting of this section.
39021	TS	0				The TS introduces the recommendation that the report make risk management a unifying perspective. This is not done but could be a useful framework as revisions are taken.	Rejected. We accept that it may not be always visible, but risk management is a central theme of the SOD version. We have worked hard to make this more visible in the re-darfting.
39022	TS	0				The introduction indicates that the TS summarizes additional knowledge/information since AR4. Very little of such information is provided in the chapter - and it would be very valuable to do so.	Noted.
40782	TS	0				Table 6.1 and 6.2 are important table and should be treated in SPM, and TS.	Accepted. We have included a table similar to Table 6.1 of the SOD.
40880	TS	0				It is obvious that mitigation measures/policies should be taken in developing countries, where GHG emissions are rapidly increasing. Thus, appropriate understanding on cause and counter-measures would be very valuable.	Noted.
40881	TS	0				IPCC aims to share various information on climate change for policy makers. Therefore, comprehensive information is preferable for their integrated decision making. Therefore, please introduce 650 and 800ppm scenarios, as well as 450 and 550ppm. If there is any reason to limit the scenario, please indicate the reason.	Accepted. We have made sure that throughout the summaries more figures and tables show the full range of stabilization levels. This is also reflected in the text. However, we also acknowledge the particular interest and request to inform about ambitious long-term goals such as 1.5° or 2°C.
40882	TS	0				Table 6.1 is a very important table which should be included in the SPM and TS as well. However, it should be refined to be more explicit. The following revisions are requested: 1) explanations for each columns (e.g. the timing of the figures in the third column "CO2-eq Conc") and for the table are insufficient and should be added.	Accepted. We have included a table similar to Table 6.1 of the SOD.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40883	TS	0				) The AR4 WGIII report provided a similar table, AR4 WG3 Table SPM.5. However, the AR4 table provides global mean temperature increase above pre-industrial at equilibrium, using ”best estimate” climate sensitivity (degrees Celsius), whereas Table 6.1 provides "indicative 2100 temperature above preindustrial" . "Global mean temperature increase above pre-industrial at equilibrium" comparable with the AR4 table, and the timing when such equilibriums are reached should be provided for each category in an additional column in Table 6.1, and if such figures are not available for the AR5 categories, then the reasons for that should be explained. 3) For the right-most column, it should be more explicitly explained in the chapter text that a majority of the 450ppm scenarios and some of the 550 ppm scenarios newly developed after AR4 are overshoot scenarios, which were not included in AR4; and that therefore, the "indicative 2100 temperature above preindustrial" are based on many overshoot scenarios. At the same time, when (the possibly modified) Table 6.1 is adopted in the SPM , Table SPM.5 from AR4 WG3 should also be cited and juxtaposed, accompanied with an explicit explanation of the differences between the two tables.	Accepted in terms of overshoot scenarios. We disagree that temperature in equilibrium is the relevant metric to be shown. The literature that emerged since AR4 mainly focusses on temperatures in 2100 and exceedance probabilities, which are based on transient temperature responses.
28675	TS	0				All statements in the TS should include an uncertainty statement using the official IPCC-uncertainty language. This is especially try for the statement highlighted in bold for which information on uncertainty must be provided.	Accepted. But there are statements of facts, where the uncertainty language does not require an uncertainty qualifier.
28676	TS	0				Although it is said in the beginning that - where possible - results of the SRREN are cited in the AR5, it seems as the role of renewable energy and their mitigation potential is underexposed throughout the TS. Please cite SRREN and the role RE plays for mitigating climate change here prominently, esp. when it comes to the "energy supply" chapter. We suggest highlighting the mitigation potential of renewable energy here as it is also done in chapter 7, page 23 (7.5.3.) "These factors indicate the potential for substantial GHG emissions reduction through many forms of RE deployment". Not only the falling technology costs should be addressed in the SPM and the TS but also the newly added capacities of RE and their mitigation potential (as done in chapter 7).	Noted.
28677	TS	0				Check the main headlines and maybe harmonize TS and SPM, e.g. SPM chapter 4 "Mitigation options by economic sector" vs. TS chapter 4 "Technological and behavioral options by economic sector"	Noted.
28678	TS	0				General Remark: although a technical report should dwell on the more scientific background that underpin the results and the statements in the summary for policy makers, there should be a "translation" of the scientific reasoning into a more explanatory language. The language as such is rather clumsy with long, intertwined sentences. Sometimes a wording is used that is ambiguous and the reader has to interpret what could be meant or if it is just a mistake (e.g. the word "stringent" which is often used can have several meanings (like some action is forced by s.o. as well as an action is mandatory or the action has high priority); The explanation of abbreviations is sometimes erratic (it might also be helpful if technical abbreviations regarding not so common measures. e.g. EJ for Exajoule received a short footnote)	Accepted. We have worked on a clear and understandable language.
28679	TS	0				General statement on CO2 or CO2eq?	Rejected. It is unclear what this general statement should be.
28680	TS	0				General statement on the use of scenario categories in SPM and TS?	Noted.
28681	TS	0				Important: Many paragraphs in the TS do not contain references to the underlying reports. These must be added in each paragraph.	Accepted.
28682	TS	0				Many comments we have on the SPM also hold for the TS, and vice versa, but are not always repeated. Please check.	Rejected. It is difficult for the writing team to understand, which of the comments may be relevant outside the special context of the SPM.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28683	TS	0				Please include more information on "Social, Economic and Ethical Concepts and Methods" (chapter 3) in the TS.	Accepted. We have extended the introductory section with findings from the framing chapter (2-4). We have added further boxes, which almost all contain material from chapter 3.
28684	TS	0				There are 8 Boxes in the TS: 1 Transparency over assessment concepts and methods. 2 Choice of GHG metric has important implications for mitigation strategy. 3 Value an aggregation. (what does this mean) 4 Methodological challenges for the comprehensive assessment of co-benefits and adverse side-effects. 5 Representation of human decision-making in assessment methods. 6 Sources of natural and social system uncertainty. 7 Concepts of macroeconomic mitigation cost. 8 Discounting future costs and benefits. It is assumed that the purpose of these boxes is to provide background on the concepts and methods used. If this is the case, the effort is much appreciated. However, in their current version, the boxes are not very useful for policy makers, please include the users' perspective when writing these boxes. The language significantly be simplified and jargon should be removed, and the titles should be simplified harmonized. There are no boxes after page 22, what happened? Further boxes should be added at least on "Emission and socio-economic scenarios (RCPs and SSPs)" and on "Integrated assessment models".	Noted.
28685	TS	0				Overall, the TS reads very technical and is not at all easy to digest (see comments on SPM in general and on specific paragraphs -holds here as well since SPM borrows most text from TS). Many paragraphs have to be read more than once to be understood. The reader loses appetie to read till the end if it is so cumbersome. The graphs do not facilitate understanding but provoke the opposite. The vast majority of graphs are too small. Several graphs are definitely not understandable to a non-scientist. Some graphs are of a nice size and easy to understand, but do not convey any new or important assessment result. In general, it would be helpful it there was in interpretation of the results of the graph/table in the text and not only the key to the graph. The idea of explanatory boxes is very much welcomed. However, the current format of the boxes, not being real boxes, is very irritating. All to often you wonder about the relation of what you are reading with the previous text, when you realize you are in the middle of a box. Boxes and main text body should be presented more distinctly.	Accepted. We have worked on a clear and understandable language. Most of the Figures have been changed and improved for clarity.
29098	TS	0				The ability to make predictions of the 'integrated' models on which some results are based isn't really examined or explained. The assumption appears to be (it is nowhere spelt out) that the costs and effects of specific interventions can be estimated, even if (by implication) the totality of events cannot be. This seems to me very questionable. It's broadly if questionably justifiable in physical climate models (on the grounds of the linearity of small perturbations) but I can't see that this logic transfers with any degree of confidence to economic or social affairs. There is a paragraph in the TS that comments in very qualitative terms on this, but how this affects the quantitative results that follow is not commented upon. There is an implicit implication that uncertainty may be judged from the spread of model results, but this is obviously a flawed argument. What would be the claimed level of skill in the absence of intervention (for example, what will be the cost of oil in 2070)?	Accepted - box on IAMs added.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29099	TS	0				The diagrams througout have a tendancy to be rather difficult to interpret. The diagrams should help to clarify and illustrate the point being made in the text and this is not always the case. This could be improved by clearer keys and captions and improved links to the discussion in the text. Furthermore, figure captions commonly contain errors and inconsistencies that add to the difficulties in interpretation. this is a general comment but specific diagrams are also identified in the comments below.	Accepted. We have worked hard to improve these aspects.
29100	TS	0				The use of confidence staments in brackets after heading is inconsistent. For some statements there is no comment whilst for others the comment varies between 'confidence' and 'evidence'. A consistent approach would be beneficial.	The uncertainty guidance allows for this. Statements of fact do not require an uncertainty qualifier.
29101	TS	0				Acronyms and units are not consistently given in full/ explained throughout the text.	Accepted.
25463	TS	1		59		consider deleting those which have "low evidence, low agreement"	Reject. Low evidence, low agreement findings can still be related to highly policy-relevant questions.
25464	TS	1		59		some of the headlines have no evidence or agreement	Noted. Statements of fact do not need uncertainty qualifiers. Please see IPCC uncertainty guidance.
25466	TS	1		59		use "carbon di oxide capture" in stead of "carbon capture" throughout the document	Noted.
30695	TS	10				Suggest having the legend for the 4 factors (coloured lines) outside the LAM panel, preferably at the side or top of the entire Figure so it is prominently displayed. What are the insets in each panel? These are impossible to read and there is no reference to them in the caption.	Accepted. Figure TS.2 has been changed in its layout to make it easier comrprehandable.
25431	TS	10				Need to reference figure in text.	Accepted.
39045	TS	10				The graphs are hard to read. The lines need to be properly labeled.	Accepted. Figure TS.2 has been changed in its layout to make it easier comrprehandable.
39046	TS	10				Line 1 on page 10 of the TS says: "Historically, higher levels of economic growth are associated with increasing emissions." This line seems to be associated with figure TS.5. However, many conclusions can be drawn from figure TS.5, which is no less than 12 graphs in one. The take-home point for this figure could instead be "Since 1970, the rate of growth of emissions in Asia has been much faster than in the rest of the world." Or, it might be "Since 1970, OECD90 energy-related emissions have increased at less than half the rate of per-capita GDP, while energy-related emissions have grown more rapidly than per-capita GDP in most of the rest of the world." The actual description of this figure in the text in chapter 5 stands in strong contrast to its treatment in the TS. Chapter 5, page 15, lines 8-20: "At a regional scale, all regions achieved modest reductions in CO2 intensity in energy (2% to 34%) with an exception of Asia, where CO2 intensity of energy increased by 44% during the same period. In particular, the strong growth in GDP per capita in Asia combined with its population growth has been the largest contributor to the increase in GHG emissions." Figure TS.5 seems to be presented in a completely different manner, in order to make completely different points, in the TS compared to chapter 5. The authors need to represent the findings from the underlying chapter more accurately.	Noted. We have simplified this figure.
24154	TS	10	10	10	11	I DO NOT see why GHG concentration will exceed 850 ppm by 2100. You should say, for instance, "majority of scenarios will exceed XXX ppm by 2100" instead of 2 lines with bold letters.	Accepted. We have changed the language - even not exactly as suggested by the reviewer.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23157	TS	10	10			See comment for SPM p. 9 l. 13	Rejected. Please provide all information. This comment will be addressed on the SPM level and implemented also in the TS, if accepted.
22893	TS	10	10	10	11	There are baseline scenarios with low emissions. For example SRES B was one of example. The sentence need more careful wordings.	Accepted.
29114	TS	10	10	10	20	This is the first reference to actual atmospheric concentrations in PPM. There is no introduction to this. In contrast, emissions in Gt/yr are introduced with reference to time-series changes such as Figure TS.1. It may be helpful to show a similar timeseries for GHG concentrations in ppm by way of introduction here.	Rejected. This is the realm of Working Group I. But a reference to the Working Group I report could be added.
20830	TS	10	11	10	13	It is true that the emission growth wouldn't be mitigated by technologies if we consider their improvement from the standpoint of nowadays technological system. However, transferring best available technology to developing countries made it possible to largely reduce GHG emission all over the world. Therefore, it is important to improve current technologies as well.	Rejected. This is a key finding on atmospheric concentratiokns pathways in baseline scenarios. The importance of improving and using todays technologies for climate change mitigation or technologies that may be available in the future is treated extensively in subsequent paragraphs.
21445	TS	10	11	10	13	The description of the relationship between economic growth and emissions trends is not balanced and does not include any analysis on decoupling trends nor any evidence that shows that there is not a unique correlation between growth and emissions depending on the time period chosen, region, etc. (TS 2.2, p.10)	Rejected. This is a paragraph on baseline scenarios. The underlying chapter makes it very clear that economuc growth remains a major driver of emissions.
21446	TS	10	15			RCP appears here for the first time, it is not explained what this means.	Accepted.
22828	TS	10	15			RCP appears here for the first time, it is not explained what this means.	Accepted.
29115	TS	10	15		16	Please expand acronymn "RCP" and explain " RCP scenarios" as don't think they have been defined so far in the TS. Also a radiative forcing figure (W/m2) is cited here: please define/ explain the use of these figures.	Accepted.
39044	TS	10	16	10	16	What are the "6.0 and 8.5 pathways"?	Accepted.
28727	TS	10	5			Figure TS.5: Caption: Explain "Four factor decomposition" (there are 5 lines in each graph). See also our comments on region definitions	Noted.
28728	TS	10	5	10	9	Figure TS.5: The figures are too small and should be enhanced in size (e.g. 2 figures in a row). It should be explained what GDP/Cap, Energy/GDP, Energy CO2/Energy, and Energy CO2 (territorial) is. The insets embedded within each figure cannot be read at all (Therest?). Furthermore, the insets might be too much information in one figure. The legend for colored lines in LAM should rather be put outside the figures at the bottom of the figure as legend for all boxes, and bigger. The titles (regions) should always be above the figures.	Accepted. The Figure has been re-drafted to make it easier to read.
28729	TS	10	15	10	15	Please give a reference where to find a definition of RCP (Representative Concentration Pathways).	Rejected. RCPs are defined in the glossary. It is not possible in a concise summary document to refer to the glossary for all the various terms, which are recorded there.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26292	TS	10	11	10	13	The sentence states: "This emissions growth will not be meaningful ameliorated by improvements in technology or the nature of remaining fossil fuel resources." Maybe is better to say: "This emissions growth will not be controlled by (…)" or "This emissions growth will not be reduced by (...)". The verb "ameliorate" can induce a misleading lecture as if we wanted to increase emissions.	Accepted. We have clarified the language, but not used the one proposed here either.
20030	TS	10	11			Check if "high confidence" is correct, as it is "medium confidence" in the ES of chapter 6 (p.5 line 29) .	Noted.
23029	TS	10	5	10	9	MAF(Middle East and Africa). Grouping these regions together is not realistic since the two are at different developmental stages	Rejected. Aggregations are always difficult, but this one is frequently applied in the literature. There are more disaggregated graphs in the report and we also use other classifications in the report.
30696	TS	11	1	11	2	1. Suggest adding the word "such" between "most" and "projections" to make clear that the projections referred to are the ones in the previous sentence (land-use changes projections). 2. In general, the phrasing of the corresponding text in Ch. 6 is better than here (CH. 6 page 15 lines 3-4. Suggest some rephrasing to say "..in the long run; however, unlike in the AR4, none of the more recent scenarios project growth in the near-term."	Noted.
23158	TS	11	1			The enormous GHG concentrations of the beginning of this paragraph are not consistent with “most projections suggest declining annual net CO2 emissions”.	Accepted - text revised.
21447	TS	11	1			but none of the more recent scenarios projects growth in the near-term as in AR4. [6.3]' ; not clear what is meant here	Noted. This finding has been completely reworked.
28730	TS	11	1	11	2	Maybe this finding should be highlighted by putting it in a separate paragraph.	Noted.
28734	TS	11	14			Please define "final energy intensity".	Noted.
30697	TS	11	17	11	26	Throughout much of the following text of the TS there is reference to "transformation", "transformation pathways" and "transformation scenarios". It might be useful to introduce this terminology here.	Noted.
25600	TS	11	17	11	26	Delete all or add ",which are heavily discussed in international climate change negotiations." that is same as the SPM.(See comment No.3)	Noted.
26182	TS	11	17	11	19	Please add 'with temporary overshoot' after 2℃ warming.	Rejected. There are many scenarios without temperature overshoot in the literature. Such a qualification would be inappropriate.
25651	TS	11	17	11	19	This part should explain unlimited evaluation results because it is prejudicial and misleading to put an emphasis on limited scenarios from 1.5℃ to 2℃. IPCC should be policy-neutral and should have responsibility to indicate unlimited evaluation results, as described in Table 6.1. The 1.5℃ target is not realistic and even 2℃ target is extremely difficult to attain, as described in (Höhne, 2011, conclusion) and (Rogelj, 2011, abstract). These literatures are listed in the No4 line of this table.	Rejected. In this particular paragraph it is appropriate to highlight these two goals, which are heavily discussed in international climate change negotiations. Subsequently we have made sure that evidence for the exploration of a broad range of temperature/concentrations goals is provided.
21451	TS	11	17	11	17	Change to "It particularly focuses on the technological" as temperature rises other than 1.5 and 2 degrees are assessed.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25538	TS	11	17	11	19	A comment similar to the one made for the SPM. In my reading of the text of the entire TS, the TS currently does not mention the 1.5°C target at all, and only provides information about less-than-likely-chance options for limiting warming below 2°C. I suggest removing this text in order to avoid putting at peril scientific credibility, or, even better, rephrase the text to read as follows: "This TS largely fails to address issues related to the 1.5 and a stringent (>66% chance) 2°C target, because the intercomparison studies underlying this assessment did not consider such low temperature targets. The current absence of information on the implications of such stringent targets is no indication of the attainability or adequacy of these targets. " Then the paragraph could continue with the current text starting with "Information...". Papers that look at 1.5°C are available in the literature, for example: (1) Ranger, N., L. Gohar, J. Lowe, S. Raper, A. Bowen & R. Ward (2012) Is it possible to limit global warming to no more than 1.5°C? Climatic Change, 111, 973-981, 10.1007/s10584-012-0414-8. (2) Rogelj, J., D. L. McCollum, B. C. O'Neill & K. Riahi (2012) 2020 emissions levels required to limit warming to below 2°C. Nature Clim. Change, advance online publication, 10.1038/nclimate1758. (3) Rogelj, J., D. L. McCollum, A. Reisinger, M. Meinshausen & K. Riahi (2013) Probabilistic cost estimates for climate change mitigation. Nature, 493, 79-83, 10.1038/nature11787.	Accepted. A key finding on 1.5 has been added to the final draft of the TS. However, this highlights the limited understanding of these requirements due to very limited evidence in the literature.
28735	TS	11	17	11	22	The statement on the focus of the TS on the two temperature goals is not a scientific result. In addition, it is not a decision of the IPCC what will be discussed under the SBI/SBSTA topic on the Review of the LTG and the progress toward reaching this goal. Parties under the Convention will decide which scientific information is relevant. Please delete this paragraph.	Rejected. The two temperature goals have received particular attention under the UNFCCC. In fact, the UNFCCC asked the IPCC to summarize relevant scientific evidence.
21452	TS	11	19	11	21	It cannot be left to the Synthesis Report to cover these aspects. The SYR will only be able to pick up information already covered in the WG reports and thus it is important that it is provided here. This sentence: "this focus… in the synthesis report" is also a political statement which is not relevant for the summary and should therefore be deleted.	Rejected. The discussion of long-term goals requires information on the physical science, climate change impcts as well as all human response options.
28736	TS	11	27	12	5	The paragraph on sustainable development should be extended. Executive Summary of Ch. 4, p. 5, line 38-49 states a very important aspect that should be included in TS (also in SPM).	Noted.
21449	TS	11	3	11	12	No motivation is given why a focus is put on 450ppm vs. 550ppm. How is this linked to temperatures? Why analyse 550ppm and not 500ppm or 600ppm? this whole paragraph should better appear in sec TS.3. otherwise the connection to 2 deg is not clear and this is introduced in the beginning of sec TS.3	Accepted. In the final draft a broader range of long-term atmospheric GHG concentration levels is considered.
21448	TS	11	3	11	4	It is not robust to state that "improvements in carbon intensity are required at a pace unprecedented in human history". This is too generic. There is literature that shows that past decarbonisation rates in specific countries during specific period could be compared with changes in projections.	Rejected. The literature shows clearly that for low stabilization scenarios carbon intensity of energy needs to approach zero and in many cases has to become negative in the second half of the 21st century.
22830	TS	11	3		12	no motivation is given why a focus is put on 450ppm vs. 550ppm. How is this linked to temperatures? Why analyse 550ppm and not 500ppm or 600ppm? this whole paragraph should better appear in sec TS.3. otherwise the connection to 2 deg is not clear and this is introduced in the beginning of sec TS.3	Accepted. In the final draft a broader range of long-term atmospheric GHG concentration levels is considered.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28731	TS	11	3	11	12	The para is very pessistic about reaching low emission scenarios on the one hand, but on the other hand quite vague about the reasons. Please reformulate in a more neutral way.	Rejected. The paragraph is not formulated in a pessimistic way. It simply highlights that the carbon intensity of energy has to be reduced at rates far beyond our experience. Ultimately it needs to be reduced to zero or even become negative for ambitious scenarios (e.g. 450ppm CO2eq in 2100). Note that this whole discussion has been restructured in the final draft of the TS.
28733	TS	11	5			"will likely have to make..." is this IPCC uncertainty language? Then should be printed in italics.	Accepted. This is an inappropriate use of the term "likely".
28732	TS	11	5	11	12	"a great deal of uncertainty" is not a helpful statement, please use IPCC uncertainty language.	Accepted.
21450	TS	11	7	11	13	the end of the paragraph is unclear	Noted. It simply says that human society will continue to require energy. This explains the importance of decarbonising energy at unprecedented rates.
28737	TS	11		24		Please include a figure on potential drivers for future emissions based on scenario results, similar to Fig. TS.5. This might also help to better understand the assumptions in the different scenarios and models.	Accepted. A four figure panel has been included with developments in per capita GDP, population, energy intensity per unit GDP and carbon intensity of energy.
21419	TS	11		11		Suggest (1) printing the unit of the y-axis on the figure; (2) replacing Co2-e with CO2-e to avoid mis-understand for Co could mean cobalt.	Noted. The figures has been removed.
26293	TS	11	13	11	15	There is no explanation of units in the "y" axis for the figures.	Accepted. Note that the figures has been removed in the final draft of TS.
20032	TS	11	19			Add "which are heavily discussed in international climate change negotiations." after "1.5 and 2 degree C warming" at the end of the sentence, as in SPM (p.9 line33-34) to clarify the reason.	Noted.
20031	TS	11	7			"less flexible" instead of "more flexible"?	Noted. This particular part of the text has been removed from the TS.
34723	TS	11	17	11	19	It is said here that the section TS.3 would focus on the technological, economic and institutional requirements of scenarios that explore the neighbourhood of a 1.5 and 2 degrees warming. However, this seems to be the only time 1.5 degrees gets mentioned. A reader would benefit from understanding the implications of the scenarios for the 1.5 degrees target that more than 100 countries have been supporting in the UNFCCC negotiations. For example, what is the probability of remaining below 1.5 for 450 ppm CO2-eq stabilization scenarios. (Could be discussed in TS.3.2)	Accepted. A key finding on 1.5 has been added to the final draft of the TS. However, this highlights the limited understanding of these requirements due to very limited evidence in the literature.
23030	TS	11	29	11	35	Definition of what Sustainable Development means is not complete here since reference is only made to the future and ignoring the present, yet we know that the present dictates what the future will be.	Rejected. The current text says: "SD implicates concerns about social justice within and between generations." The finding was revised substantially.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28739	TS	12	13	12	14	"…two important perspectives - the process through which decisions are made and the outcomes of such processes -…" This ends rather abrupt. A short explanation what distinguishes outcomes and processes should be added. (see also comment on SPM p. 9, line 11-12)	Noted.
28740	TS	12	14	12	14	"…and many different methods for assessment." Make new sentence and add some few examples which assessment methods this might be, e.g. from Ch 3 sec 3.5 cost-benefit analysis (see also comment on SPM p. 9, line 12)	Noted. This entire section was changed in the writing of the final draft. With the final material emerging from the chapters, authors decided to change the flavour of this section.
28741	TS	12	15	12	15	The second reference in the bracket is wrong. It should be "3.3" rather than "3.10".	Accepted.
28742	TS	12	25			The last paragraph within the Executive Summary of Ch. 3 (p. 8, line 1-3) should be included in TS (p. 12, following paragraph line 16-25). "Achieving strong mitigation will require major technological and behavioral changes. Markets, left to their own devices, will underprovide technological change, even in the presence of a carbon price. Studies suggest that environmental and technology policies work best in tandem."	Noted.
23504	TS	12	26	12	46	Perhaps the broadening discussion about definition and measurement of wellbeing should also be mentioned here, i.e. not only in economic terms but also in terms of health and mental wellbeing, education, participation in society, etc. (e.g. Stiglitz, J. E., et al. (2011). Mis-Measuring Our Lives. New York, The New Press).	Noted.
39048	TS	12	26	12	46	Box TS.3: not the case that climate change in isolation affects all of those values. It may, especially in the context of broader considerations and factors that influence values and well-being.	Noted - box was replaced.
39049	TS	12	26	12	46	The recommendation to use distributional weights in cost-benefit analysis is too prescriptive and does not reflect the state of the literature. First, there is no consensus on which weights to use. Second, use of weights in a national cost-benefit analysis could give greater weight to non-citizens than citizens, which could violate the notion of sovereignty. The chapter should instead acknowledge that the choice of weights could lead to significant differences in the results from CBA. An alternative approach to using weights is to conduct unweighted CBA as well as a separate distributional analysis that policymakers can consider as distinct criteria for policymaking. A useful reference for the effect of weights on the results of CBA of climate policy is Anthoff and Tol (2010) in JEEM - also available at: http://ideas.repec.org/p/ces/ceswps/_2373.html	Noted - box was replaced.
28744	TS	12	26			Box TS.3: What does the title mean?	Noted - box was replaced.
28743	TS	12	26	12	46	Box TS.3: The box should explain the concept of using mathematical functions to analyze the effects of climate change and mitigation options, the different approaches and associated difficulties and uncertainties, and the effect these have on the results presented. The last sentence of the box suggests that the effects are significant and that, therefore, the statements on different mitigation options are problematic, and hence are not of much use for policy makers.	Noted - box was replaced.
28745	TS	12	26	12	46	The position of Box TS.3 is confusing because the box's content is related to the paragraph (line 6-15) rather than the following paragraph (line 16-25). Therefore, Box TS.3 should follow after the related paragraph, i.e. from line 16 onwards. The paragraph on co-benefits and/or adverse side-effects should be moved behind Box TS.3	Editorial
28746	TS	12	28			Box TS.3: "according to some views" is not a valid uncertainty qualifier, please used agreed IPCC uncertainty language, or delete.	Noted - box was replaced.
21453	TS	12	40	12	46	This paragraph should appear also in the SPM, as in the SPM only some bold questions about ethics are asked but no answers are given. This paragraph at least gives some first hints	Accepted - text revised
22831	TS	12	40		46	This paragraph should appear also in the SPM, as in the SPM only some bold questions about ethics are asked but no answers are given. This paragraph at least gives some first hints	Accepted - text revised

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19506	TS	12	43	12	46	I find the statement that not using distributional weights to lead to "serious error in cost-benefit analysis" to be an overstatement and too prescriptive for an IPCC report. There is no concensus about the appropriate weights to use in cost-benefit analysis, and since these weights have a strong subjective component, it does not seem supported to say that one particular approach leads to "errors." Instead we can say that different weighting schemes could have very different results, and that sensitivity analysis using different weights would be informative to policymakers.	Noted - box was replaced.
39050	TS	12	43	12	46	Delete the normative statement that not using distributional weights in cost-benefit analysis "could lead to serious error in cost-benefit analysis." There is no consensus on what weights to use in the literature, and use of weights may be in appropriate in a domestic cost-benefit analysis if it gives more weight to non-citizens than citizens. The text could instead make the more objective point that the choice of weights could significantly affect the results of cost-benefit analysis.	Noted - box was replaced.
39047	TS	12	6	12	15	This paragraph makes mention of "fair outcomes". It would be helpful to have more on who defines "fair" and how	Rejected. The paragraph provides the two main concepts of fairness: which is processed and outcome based assessments of fairness.
40890	TS	12	6	12	15	Ethical considerations should be further clarified by adding lines from Chapter 10 Page 4 line 45 - page 5 line 2: “Level of demand for services/products has significant effect on the activity level in the industry sector. Thus, absolute emission reductions can also come through changes in lifestyle and corresponding demand levels directly (e.g. for food, textiles) or indirectly (e.g. for 1 product/service demand related to tourism).”	Rejected. This is not relevant for the intended paragraph. Such a sentence would be more relevant in the context of TS.2 oder the subsequent sections in TS.3.1.
28738	TS	12	6	12	15	This paragraph is not very helpful because it gives very little indication on what to conclude from this. The most part of the paragraph lines one question after another. In order to make this more useful, I suggest to begin the paragraph with a bit of information/explanation, i.e. integrate two additional paragraphs out of the Executive Summary of Ch. 3 (i.e. p. 5, line 21-27) prior to the row of questions raised. The questions are useful to give an overview over what needs to be considered, but should not stand alone. (see also comment on SPM p. 9, line 4-12).	Noted.
33956	TS	12	43			“leads” is “lead”	Editorial – copyedit to be completed prior to publication
20033	TS	12	20			Replace "and to avoid trade-offs" with ",taking into account trade-offs", as the problem is to maximize utility of a society, balancing marginal utility of each objective and taking trade-offs into account, where trade-offs almost always (unavoidably) exist.	Noted.
29116	TS	12	26	12	46	Title of box: Should this be "Value and Aggregation"?	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32601	TS	13				Box TS.4 on co-benefits. A careful reading of the literature and sectoral chapters points to the conclusion that co-benefits are far more important than many of us have previously realised. My comment here couples with my (distinct) comment on the topic in Chapter 3, though both suffer from the problem of treating co-benefits as largely static and separable when in fact they are typcially dynamic and integrated with development. The perspective we eventually came to in the book Planetary Economics (Grubb et al., 2013, Chapter 1) was that economic development itself involves to an improtant degree the internalisation of externalities. Thus, private transactions start by largely ignoring the impact on those external to the transaction; as those impacts grow and the victims get a voice, they start to force action. Resisting the internalisation results in inefficiencies because they impose real costs on the wider society, costs which tend to build up until finally addressed. Witness the costs of local (or indeed now regional) pollution in China. Climate change is logically a culmination of this process. A crucial point, however, is that by forcing attention to long term carbon cumulation, it may be possible for countries to "short cut" the steps that industrialised countries have gone through - concerning the "co-costs" of fossil fuels, by lowering dependence on fossil fuels themselve rather than by suffering local environemntal damage and then installing lots of clean-up equipement, stratetic stockpiles, etc etc. Moreover, the empirical data is clearly that the level of pollution control in even the most extensively regulated industrialised countries (eg. US sulphur) remains far from optimal (see the US National Academy and JES studies cited in Planetary Economics (Chapter 6). Similarly, subsidy removal and "true pricing" are clearly beneficial, but likewise they are very difficult to achieve to the optimal level because of societal resistance to paying "true costs". Hence there is huge scope for co-benefits, which are also a motivator of action - and in many countries, a dominant one to which CO2 mitigation may be an incidental benefit. The framing of this box completely misses this evolutionary and empirical reality. It simply misses the point. This evolutionary perspective on "co-benefits" is, incidentally, another reason why "business as usual" is rarely optimal. It would help enormously if this box coudl be more clearly crossed linked to the empirical data including in Chapter 5, section 5.7, and Chapter 6, section 6.6.	Taken into account - text revised
28747	TS	13	1	13	32	Box TS.4: The aspect of adaption as an additional - sometimes conflicting - objective should be mentioned. The box is too long, the language to difficult (in particular, the meaning of the text in lines 21-24 is not clear. The reference to Fig. TS.9 does not help.) Please add clear statements on uncertaintenty using IPCC-language instead of pure prose on problems.	Taken into account - text revised
28748	TS	13	26	12	46	Box TS.4: The difference between box 3 and box 4 is not completely clear. Are cobenefits/side effects not considered in value aggregation functions?	Noted - box was replaced.
39051	TS	13	33	13	33	Here it is helpful to give a brief description of the modeling approach employed to carry out scenario analysis, for example, what type of modeling was done, how many models were involved, to set stage and reference for "ensemble" results presented later in the summary. Same should be done in the Chapter (5).	Noted.
30698	TS	13	34	13	34	Does "efficient" here mean "cost efficient"? If so, please say so.	Rejected. Efficient is used cost-effective. We have tried to make this clear throughout the section now.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39052	TS	13	34	14	4	This is two sections discussing temperature targets, concentration targets and climate sensitivity. It is confusing because the first section beginning on line 34 discusses the 2 degree C target saying, "...a long term equilibrium concentration of 450ppm CO2eq corresponds to a two degree increase in global mean temperature. The very next section beginning on line 43 says, "Atmospheric concentration pathways cannot be directly linked to a specific temperature pathway..." This seems to contradict itself. It would be better to give the range of climate sensitivity in the first section and discuss the uncertainty around trying to pair temperature and atmospheric concentration.	Accepted. We have re-drafted this part of the TS.
28749	TS	13	34	13	42	Please give more information on uncertainties (IPCC-language), and on how the pathways are constructed to reach a certain temperature stabilization level. Please explain "climate sensitivity".	Accepted. We have added a box on climate sensitivities highlighting also the differences in usage to AR4.
34724	TS	13	35	13	39	It should be clarified here that even though a range of pathways could be constructed to meet any long-term stabilisation goal, the pathways won't have equal impacts, risks and technical or social feasibility. So what also is a key factor influencing the choice between different pathways is how big risks are considered acceptable, in terms of impacts (of overshooting), technical feasibility (to what extent one relies on technologies that come with major uncertainties) and relying on future decision-makers. Overshooting is discussed a lot, but whether it matters - other than having to then do BECCS - is not discussed.	Accepted. We have done this at a different point, but will clarify this at the outset.
30699	TS	13	36	13	38	These lines are unclear. They seem to suggest that decision-makers will choose between pathways based on knowledge about the key uncertainties. Perhaps what is intended is to say that "the shape of the pathways are influenced by assumptions made about key uncertainties, such as .....climate sensitivity, future costs and availability of technology etc.". Then decision-makers will make choices about the timing of emission reductions based on their assessment of the assumptions behind the different pathways.	Accepted. We have redrafted this part of the summary.
30700	TS	13	39	13	42	1. It would be helpful to provide a specific reference to where in the WGI report the most likely value for climate sensitivity of 3.0 W/m2 is given. 2. The text should be expanded to explain what climate sensitivity refers to. This term is no doubt defined in the WGI glossary and may be in the WGIII glossary, but it is essential information to understanding the next sentence (linking 450 ppm CO2-eq to 2 degrees C); therefore, an explanation is required right in the text. 3. The two sentences on lines 40-42 require a more specific reference. I could not find supporting text in sections 2.4 or 6.3 (other than a casual reference in FAQ 6.1 to "many researchers have used the notion of a 450 ppm CO2-e concentration goal as a proxy for the 2 degree goal." If the WGIII TS (and SPM) are to make repeated references to a 450 ppm CO2-eq climate goal (which they do in the current drafts), then a more robust explanation for why this is a good proxy for the 2 degree goal is required.	1.) Rejected. WG1 does not provide a most likely estimate. This decision was taken before the SOD was written, but will be reflected in WGIII final draft TS. 2) Accepted: we added a box on temperature. 3) This part has been re-darfted noting these remarks.
25539	TS	13	39	13	40	Climate sensitivity is expressed in K, not W/m^2, please correct.	Accepted.It is expressed °C/(W/m^2).
25563	TS	13	40	13	40	"Climate sensitivity is 3.0 degrees C"? (Not "3.0 W/m2")	Rejected. It is expressed °C/(W/m^2).
21455	TS	13	40			the unit of climate sensitivity should read degrees C/(W/m^2)	Accepted.
21456	TS	13	40	13	42	this sentence of how 450ppm relate to 2deg should come much earlier, as this is the motivation and justification why 450ppm is analysed in detail	Rejected. It is the first paragraph on the analysis of mitigation pathways.
22832	TS	13	40			the unit of climate sensitivity is °C/(W/m^2)	Accepted.
22833	TS	13	40		42	this sentence of how 450ppm relate to 2deg should come much earlier, as this is the motivation and justification why 450ppm is analysed in detail	Rejected. It is the first paragraph on the analysis of mitigation pathways.
32210	TS	13	40	13	40	3.0 W/m2 per doubling CO2	Rejected. Climate sensitivity is defined in °C/(W/m^2).

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25541	TS	13	40	13	41	For your information: a 450 CO2eq concentration stabilisation would result in a less than 50% probability of limiting warming to below 2°C. Assuming an average climate sensitivity distribution consistent with the WGI climate sensitivity assessment, limiting long-term warming to below 2°C with at least 66% chance would require stabilising CO2eq concentrations of all forcers to below 415ppm (see Figure 2, Rogelj et al, 2012; the updated assessment of WGI AR5 would not change these statements to a significant degree). Reference: Rogelj, J., M. Meinshausen & R. Knutti (2012) Global warming under old and new scenarios using IPCC climate sensitivity range estimates. Nature Clim. Change, 2, 248-253, 10.1038/nclimate1385.	Noted.
25540	TS	13	40	13	42	This is very imprecise, not consistently reflecting WGI science and, if formulated less elegantly, arguably wrong. A 450 CO2eq concentration stabilisation would result in a long-term temperature increase 2.1K (information already provided in the AR4, WGI, Table TS.5, the best estimate climate sensitivity value hasnot changed in AR5), and thus a less than 50% chance of limiting warming to below 2K. I don't know any occasion in which such an interpretation (less than 50% chance to stay below 2°C) is used as a proxy for the 2°C goal. It would be good if this paragraph could reflect this caveat in terms of scenario categories in WGIII. Alternatively, one can maybe refer to the transient climate response, instead of climate sensitivity, as that charateristic of the climate system is probably more relevant for the warming projected for this century.	Accepted.
25542	TS	13	42	13	42	This statement fails to appreciate the fact that both the Durban Platform text (UNFCCC, 2011) as the Doha Gateway text (UNFCCC, 2012) make reference to grave concerns that the process is not on track to limiting warming to below 2°C with a "likely" chance. The "often" in this sentence thus seems quite inappropriate.	Rejected. We do not see how the comment relates to what is written in TS. In any case, the entire section on temperature has benn re-drafted following the emergence of the final material from chapter 6.
25564	TS	13	43	14	4	Does the insight "the probability of remaining below the 2 degree C target is approximately 60% for scenarios aiming at stabilizing atmospheric GHG concentrations around 450 ppm CO2eq in 2100" come from the WG3? I do not think so. Estimates of probability density functions for climate sensitivities are the matter of WG1. In addition, the estimates are still very uncertain. The probability of "60%" is not a reliable number. Therefore, this part should be deleted.	Rejected. The Working Group III literature deals with exceedance probabilities and temperature estimates. This needs to be covered in Working Group III. In any case, the entire section on temperature has benn re-drafted following the emergence of the final material from chapter 6.
25565	TS	13	43	14	4	The 450 ppm CO2eq "stabilization" will almost correspond to the "equilibrium" temperature of 2 degrees C. However, the equilibrium temperature of 2 degrees C is reached only in very far future, and the temperature rises in 2100 and even in 2200 are lower than 2 degrees C under 450 ppm CO2eq stabilization pathways. In addition, the overshoot scenarios of 450 ppm CO2eq in 2100, which types of scenarios are many in Category 1 of Table 6.1, cannot define "equilibrium" temperature due to the overshoot and declining emissions after 2100, and then the scenarios will not reach the 2 degrees C in 2100 and even in 2300. The IPCC report should clearly describe this fact by using Table 6.1 and by explaining the differences in collected scenarios between AR4 and AR5.	Accepted. We do not agree with the first half of this comment, but acknowledge the need for including a table similar to the one suggested by the reviewer.
25543	TS	13	43	14	4	This paragraph would benefit of an indication of the time horzon that is looked at. At a 3K climate sensitivity 500 ppm CO2eq scenarios would have a temperature increase of roughly 2.5K, which is not consistent with 40 or 50% below 2°C. An indication of the time horizon (by the end of the century) and an explicit mention of this caveat related to long-term warming versus end-of-century would be helpful.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40891	TS	13	43	13	45	This viewpoint is very important. It should be clearly described that uncertainty of temperature pathways are not precise enough to discuss the marginal difference, such as 0.5 degree Celsius.	Noted. The entire section was re-drafted following the consideration of the final material from chapter 6. We do not understand what is meant with the second sentence. Does this refer to impacts? This is the realm of Working Group II. We know that higher concentrations are associated with a higher probability of exceeding a certain temperature goal.
28750	TS	13	43	14	4	Temperature ranges shown in Table 6.1 in chapter 6 should be shown here. Categories should be presented in a box.	Accepted. A table similar to Table 6.1 has been incorproated in SPM and TS.
34725	TS	13	47	14	2	It would seem more relevant here to present the probability for 550 ppm scenarios (to stay below 2 degrees), than 500 ppm, because the whole of WGIII focuses on comparing 450 ppm and 550 ppm scenarios. Here's where also these scenarios' probability of keeping below 1.5 degrees should be discussed.	Accepted. A table linking emissions, concentrations and temperatures across scenario categories has been added.
25652	TS	13	48	14	1	This part should be revised to be consistent with the description of section 6.3.2.5. and Table 6.1. In the section, it is described that the probability of category 2 is about 40-50%. And the CO2-eq concentration for category 2 is 485-535 ppm in the Table 6.1. Therefore, the probability for 550 ppm should be less than 40-50%.	Accepted. Such a table has been added and this part of the TS has been revised.
21454	TS	13	5			explain "Type I and Type II" does it refer to box TS6 ?	Accepted. This is jargon, which has been removed.
33957	TS	13	31			“disjunctive studies”?	Noted.
21420	TS	13	47	13	48	This seems to refer to the scenario with immediate action. If so, suggest stating it clearly.	Rejected. There can also be scenarios without immediate action for which this may hold.
32388	TS	13	39	13	40	Suggest to add the full ECS range to this most likely value (WGI Ch12 ES).	Noted.
32389	TS	13	40	13	41	The sentence "At this level, a long-term equilibrium concentration of 450ppm CO2eq corresponds to a two degree increase in global mean surface temperature" cannot be traced in the chapter sections provided as line of sight. This sentence represents a major oversimplification without any uncertainty range and has to be flagged as such.	Noted.
20035	TS	13	47		48	Add some phrases from SPM (p.9 line 26-28) so that the sentence can be read "Studies indicate that the probability of remaining below 2 degree C warming without temporary overshoot is approximately 60% for scenarios aiming at stabilizing atmospheric GHG concentrations around 450ppm CO2-eq in 2100 if economically efficient mitigation begins immediately. " to be more clear.	Noted. The entire paragraph has been re-phrased.
29754	TS	13	48	14	1	500 PPM or 550 PPM?	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25568	TS	14				The number in the table is literatures which only the LAs gather without systematical treatments. This is really inappropriate and misleading. Table TS.1 should be deleted. Some of the reasons are as follows. 1. CEA/CBA or strategy criteria under uncertainty (e.g., mini-max strategy, minimum regret strategy) is a key rather than the factors of this table. 2. Some unclear categorizations were observed (e.g., Boetti et al., 2009). 3. Unclear selections of literatures were observed (e.g., Webster et al., 2002). 4. Some candidate papers have not been referred (e.g., Oda et al., 2011; Balikcioglu et al, 2011). (also see my related comments to Section 2.4.2 and Table 2.2.)	Noted. This table has been removed from the TS.
21461	TS	14				this whole table needs much more explanation, as such it cannot be easily understood. What is meant by upstream and downstream? And what is the content of the table? What do you want to tell by giving the numbers of papers? Are there few, are there many? What is their content?	Noted. This table has been removed from the TS.
22838	TS	14				this whole table needs much more explanation, as such it cannot be understood. What is meant by upstream and downstream? And what is the content of the table? What do you want to tell by giving the numbers of papers? Are there few, are there many? What is their content?	Noted. This table has been removed from the TS.
25432	TS	14				This table is not clear. I don't really understand what it's trying to show, or how the uncertainties considered affect mitigation action. Is it saying that uncertainties in policy response, for example, may increase the rate or mitigation action according to 6 sources, and delay action according to 2 sources? I don't think this table is really that helpful.	Noted. This table has been removed from the TS.
24417	TS	14				This table is misleading. First of all, the number of peer-reviewed paper is not mutually exclusive and collectively exhaustive, just counted up the papers that authors are identified. Second, the criteria of categorization is not clear and not authorized. Third, the number of papers does not necessarily mean the degree of importance of the area. Therefore, this table should be deleted.	Noted. This table has been removed from the TS.
21457	TS	14	1			I think it should read 550ppm (instead of 500ppm), correct? At least in the SPM they write 550ppm for that probability	Noted. This finding has been completely re-drafted.
22834	TS	14	1			I think it should read 550ppm (instead of 500ppm), correct? At least in the SPM they write 550ppm for that probability	Noted. This finding has been completely re-drafted.
30701	TS	14	14	14	15	The title here could be improved because as currently worded, it seems to suggest that the number of peer-reviewed papers effects mitigation action. Suggest " Number of peer-review papers that assess the effects of different types of uncertainty on mitigation action."	Noted. This table has been removed from the TS.
28754	TS	14	14	14	17	The table is unclear, at least the description should be expanded. It seems that the number of publications does not give relevant information on content, but on the availability of scientific studies. Table could be deleted.	Noted. This table has been removed from the TS.
34727	TS	14	17	14	37	The text in the box reads: "Mitigation policies are designed to change current production or consumption decisions of actors..." One wonders why actors are considered just as producers or consumers? Surely mitigation policies can't be reduced to influencing producers and consumers only.	Accepted - text revised.
28751	TS	14	3	14	37	Box TS.6: The title sounds promising, but information on the relevance and uncertainty of the different aspects is needed (IPCC-language please). In its current form the box is not very useful.	Noted - box was replaced.
25566	TS	14	5	14	5	Please explain "Type I and Type II errors". Readers will not understand them.	Accepted. This is jargon, which has been removed.
25567	TS	14	5	14	7	Table TS.1 does not cover all the related papers. You cannot say "the balance of evidence suggests (…)". Delete or revise this sentence.	Noted. This table has been removed from the TS.
21458	TS	14	5			what are type 1 and type 2 errors? No definition is given	Accepted. This is jargon, which has been removed.
21459	TS	14	5	14	7	Not clear what is to be achieved by using this this sentence. It simply says: doing something is better than doing nothing.	Accepted. This finding has been removed from the TS.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22835	TS	14	5			what are type 1 and type 2 errors? No definition is given	Accepted. This is jargon, which has been removed.
22836	TS	14	5		7	this sentence sounds like nonenense, at least it is not at all understandable. It simply says: doing something is better than doing nothing.	Accepted. This finding has been removed from the TS.
34726	TS	14	5	14	15	Understanding this para and the table requires reading the underlying chapter. The paragraph should be re-formulated to be more self-explanatory.	Accepted. Both finding and table have been removed.
39053	TS	14	5	14	16	This discussion of type I and II errors and the associated table TS.1 are not at all clear. The caption for the table needs to be more detailed. In the discussion, is this what the response should be to uncertainty or what the response is to uncertainty?	Accepted. Both finding and table have been removed.
28752	TS	14	5	14	5	"Type I" and "Type II errors" have not been properly introduced.	Accepted. This is jargon, which has been removed.
28753	TS	14	8	14	9	Sentence unclear. What does "asymmetry of future states of nature" mean? In addition, it seems policy prescriptive, please change.	Accepted. This finding has been removed from the TS.
21460	TS	14	9	14	13	What is the "no policy case"? There is no further specification. Is it completely without policies, also without fossil fuel subsidies, taxes or e.g. the EU ETS? Or is is simply a counterfactual "baseline" without any constraints in the models? The whole sentence cannot be easily understood.	Accepted. This finding has been removed from the TS.
22837	TS	14	9		13	What is the "no policy case"? There is no further specification. Is it completely without policies, also without fossil fuel subsidies, taxes or e.g. the EU ETS? Or is is simply a counterfactual "baseline" without any constraints in the models? The whole sentence cannot be understood.	Accepted. This finding has been removed from the TS.
21421	TS	14	5	14	5	It is not clear what Type I and Type II errors are referring to.	Accepted. This is jargon, which has been removed.
20036	TS	14	1			Make the description consistent with Chapter 6, as "40% to 50%" is for "category 2" in Chapter 6 (p.25 line45-47) instead of for "550ppm scenarios" and "550ppm scenarios" should be included in "Category 3" (Table 6.1) instead of "category 2".	Accepted. Such a table has been added and this part of the TS has been revised.
40892	TS	15	3	15	37	This box explains the sources of natural and social system uncertainty, which is a very important point among the current global warming discussions. This box only lists up the research results and hard to capture the actual meanings, and for what does it stand. So it would be preferable to have a introduction and summary to make the Box more understandable.	Taken into account - box was deleted and text in Section TS.1 added.
40894	TS	15	38		0	“a rapid change to energy systems and to the use of the global land surface” is too vague as a expression placed at the head of the paragraph, and should be more concretely written.	Accepted. We tried to be as descriptive as possible in the final draft of the TS.
31364	TS	15	39	15	40	Very important finding. Please consider to supplement this with an illustration of the stablilsation scenarioes together with the past trends in GHG emissions to illustrate this finding.	Accepted. We have included a new figure and finding that relate rates of historic emission changes with required emission changes for different groups of scenarios.
30702	TS	15	41	15	41	There is no category 0 in Figure TS.7.	Rejected. There is no category 0 in the final version of the scenario database due to too little evidence. However, a finding has been included in the new draft summarizing the literature.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39054	TS	15	41	15	41	What is "More than 250 Category 0 and 1 scenarios"? It is unclear and requires further clarification.	Noted. The scenario category 0 has been deleted from the database due to a sufficient number of studies. However, a finding has been included in the new draft summarizing the literature.
29117	TS	15	41			Please define/explain category 0 and 1 scenarios	Accepted. A table has been added providing all relevant information to these groups of scenarios. The scenario category 0 has been deleted from the database due to a sufficient number of studies. However, a finding has been included in the new draft summarizing the literature.
30703	TS	15	44	15	44	Suggest adding the word "optimal" after "idealized", to make more clear what idealized means.	Rejected. All of these scenarios are "optimal" in the sense that they are the result of an optimisation procedure. But some are more idealised than other with regard to the assumptions underlying the scenarios.
34728	TS	15	44	15	48	A reader would benefit from understanding what explains such a broad range for possible pathways towards stabilizing in 450 ppm. Again, it should be explained that the different pathways (towards 450 ppm stabilization) would not come with equal impacts (on ocean acidification, for example), risks of exceeding thresholds and feasibility.	Accepted. We have added a table showing that 450 in fact was used as a proxy for describing a group of scenarios (category 1). We have been more careful in our choice of language.
28756	TS	15	44	15	45	What about the scenarios that do not allow CO2 concentrations to exceed in the interim? Shouldn't this be the main goal and stated here?	Noted. Concentration and temperature overshoot are not the same though. We have added a new table on the relationship between emissions, concentrations and temperatures, where we distinguish scenarios with large concentration overshoots from those without.
28755	TS	15	44	15	48	Box TS.6: The title sounds promising, but information on the relevance and uncertainty of the different aspects is needed (IPCC-language please). In its current form the box is not very useful.	Noted - box was replaced.
25653	TS	15	45	15	46	This part should be revised to be consistent with the description of Table 6.1 and Table 6.2. Since the CO2-eq concentration for category 1 is 425-485 ppm in the Table 6.1, 450 ppm scenario can be considered in category 1. And the emission reduction of category 1 is from -28% to +35% in 2030 and -77% to -37% in 2050, compared to 2005. Considering the total emissions in 2010 is higher than in 2005 from Figure SPM.1. The figures in this part is not consistent with the description of Table 6.1 and Table 6.2.	Accepted. We have added a table similar to the Table 6.1 this comment refers to. Emission growth relative to 2010 as in the SOD version of the TS is no longer part of the final draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22388	TS	15	45	15	46	The statement: "a reduction in global emissions below 2010 levels of 15% to over 50% in 2030 and 40% to almost 80% in 2050 [High Confidence]" is not supported anywhere in the rest of the TS or even in the SPM or Chapter 6. There is no reference indicated for this statement. There is also no basis indicated anywhere in the text of the SPM or Chapter 6 regarding the "High Confidence" rating.	Rejected. This was covered in the Table 6.2 of the Second Order Draft.
40893	TS	15	5	15	16	This sentence describes that AR4 WG2 discussed "with the conclusion that focus on potentially catastrophic low probability high-impact events is important when choosing climate change targets". However, such a description is misleading in that it might lead to a policy prospective. Furthermore, Table 2.2 where this paragraph cites is not complete to judge this result (see our comment on Table 2.2. for detail) . Above all "balance of the reports [?]which authors found[?]" is very hard to say "balance of evidence", and possibly mislead readers to wrong understanding. So please delete this paragraph and Table TS.1. From technical summary.	Accepted - paragraph and table deleted.
20037	TS	15	44		48	Make the numbers consistent with Chapter 6, as numbers are not consistent with Table 6.2 (p.21).	Accepted, but this aspect is no longer part of the TS in the same way.
30705	TS	16				Suggest adding a 4th panel to this Figure that would provide information about the various scenario categories and associated CO2-eq levels. This information is provided in the Figure caption, but would be easier to see if presented directly as part of the Figure.	Accepted. The Figure has been changed, but the suggested panel has not been added.
23159	TS	16				These scenarios are arbitrary assumptions that are not credible, not results.	Rejected. We review those scenarios that have been submitted by the community for inclusion in the AR5. This includes in total 1200 scenarios from more than 30 models.
21462	TS	16				where is the 550ppm scenario?	Rejected. Not clear what is meant with this comment.
22839	TS	16				where is the 550ppm scenario?	Rejected. Not clear what is meant with this comment.
30704	TS	16	1	16	10	Suggest that a reference to Figure TS.7 panel (b) be brought into this paragraph to support the discussion of the need for negative emissions. Reference to Figure TS.7 is currently only in the previous paragraph at the bottom of page 15 and no reference to scenarios with negative emissions is made there. Also, it would be helpful to have it made clear whether natural processes alone would be sufficient to lower atmospheric CO2 levels to stabilization levels (such as 450 ppm) within this century or whether anthropogenic measures to achieve negative emissions are required. The text is vague in this respect.	Noted. We have made clear in Section TS2.2 that mitigation measures are required. Referencing to figures has been much improved in the final draft of the TS.
40895	TS	16	1		2	The number of scenarios should be provided, clarifying the number of scenarios out of a total of how many scenarios are being referred to as"a vast majority".	Accepted. We have included a table that provides such information.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28758	TS	16	1	16	22	These two paras (carefully redrafted) could be included in the SPM. Is 2030 the new peak year from AR5??	Noted. It is important that peak years can be easily misinterpreted. We try to make clear that peaking means a greater dependency on the availability of particular technologies, which may not be available today. It takes away flexibility to hedge risks across the mitigation technology portfolio. Human society may be "foreclosing options" with later peaking, but there is little robust scientific basis to suggest peak years.
28757	TS	16	1	16	27	In the text you're referring to GHG concentrations (CO2eq) and in figure TS.7 you're just looking at CO2 emissions. That makes it hard to compare both parts. Please be consistent.	Accepted. Figure has been removed. Text has been considerably revised.
39055	TS	16	11	16	12	In the bolded section of this paragraph, spell out what CDR means. It is defined in a prior paragraph, but acronyms should be spelled out in all sections with bold face text.	Noted.
40897	TS	16	11	16	12	The pre-conditions to achieve the scenario is important. please maintain this paragraph.	Noted. The paragraph has been revised though in line with changes in the chapter.
28760	TS	16	11	16	12	The wording suggests that CDR technologies are already at hand - please reformulate, e.g.:"...delay in international cooperation m i g h t increasingly require the large-scale application of p o t e n t i a l CDR technologies…"	Rejected. The pathways DO increasingly require these technologies. Their availability is a different matter. We outline the requirements and try to qualify this.
34730	TS	16	16	16	22	What "delaying action" would mean in real terms isn't explained here (and it could be more clear throughout the report). Most countries today would claim that they are already taking action, in international cooperation, so they aren't delaying action - they are acting already, (they could claim). "Delayed action" isn't self-explanatory. A reade could understand it as delayed peak in global emissions. Or delay in getting to any pathway that would be consistent with 450 ppm. A clarification would help.	Accepted. We have revised the language in this regard focussing mainly on emission levels in 2030.
28761	TS	16	19	10	19	Please qualify this statement with regard to the assumed path of economic growth: "Sufficient delays – for example, delaying global action beyond 2030 – can render ambitious mitigation levels such as 450 ppm CO2eq by 2100 physically infeasible without a) substantial overshoot along with negative global emissions in the second half of the century using BECCS or other CDR technologies or b) a diversion from the current path of economic growth.	Noted.We have revised the language regarding "delays" to make it more concrete and factual.
28762	TS	16	19	16	19	The wording suggests that CDR technologies are already at hand - please reformulate, e.g.: "…other p o t e n t i a l CDR technologies…"	Noted. We highlight the uncertainties on availability and scale of CDR technologies in the final draft, but did so in the SOD version as well.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40896	TS	16	2		5	There is no mention about the risks and uncertainties associated with ocean uptake of CO2, such as progress in acidification or a possible decline in uptake rates in the future should be discussed with reference to WG1 SOD Chap.3 p.35 l.51-57, WG1 Chap.9 p.10 l.46-54 and WG3 Chap.4 p.31-33, AWG3 Chap.6 p78 l.21-23. It should also be noted that the major causes of ocean acidification are shared with climate change, and therefore, mitigation measures are also effective for ocean acidification.	Rejected. We only refer generally to the uncertainties regarding to the availability and scale of different CDR proposals. Details are found in the underlying WG1 and 3 reports.
28763	TS	16	22	16	22	Information on 2020 is needed. Why 2030? This seems policy prescriptive, as it turns action away from 2020. AR4 provided information on the peak year (max emissions) for a given T-increase (2015 for 2C). This informatio is missing in AR5. In addition, the UNFCCC reference year is 1990, information for this year should be included here.	Rejected. We have strengthened the focus on 2030 levels as this enables to clearly determine on what transformation pathway human society may be due to tighter constraints on the emission budget. This enables to talk more clearly about the available scientific literature.
31366	TS	16	23			In the text on p 15-18 everything is about CO2-eq, 450 and 550 CO2-eq stabilisation scenarios. It seems therefor confusing that fig TS.7 operates only with CO2, both for stabilisation scenarios and emissions. Please clarify if figure TS.7 includes non-fossile CO2, further more it would have been even better if figure TS.7 also could include the other greeenhouse gases in addition to CO2.	Accepted. This has been corrected in the final draft of TS. In fact, most figures have been revised considerably.
39056	TS	16	23			Category 4-6 scenarios are not mentioned or defined in the caption. I also don't understand why the mean line for Category 6 in the upper panel is not within its 10-90th percentile band. Finally, the emissions start around 35GtCO2/yr, but the beginning of the TS says emissions are over 50GtCO2/yr, currently. Is this because the models that produced these figures start several years before 2010? Explain why one figure relates to energy CO2 only and the other to ALL GHG.	Accepted. This Figure has been removed and replaced by one focussing on all GHGs across all scenario categories.
28764	TS	16	23	16	24	The difference between the lower panels is not clear, please add explanation to the caption. What are the conditions for the scenarios? For example, in the left panel, do the scenarios include negative emissions or not? The text in the figures does not make sense (e.g. left panel states "no negative emissions" close to the three solid lines that show negative emissions? If you are just referring to the dotted lines, the text is not needed, the figure speaks for itself). The lower panel does not include cat 4-6 ?? Fig should show CO2eq, not CO2.	noted. The Figure has been completely revised taking the comprehensive feedback from the review into account.
28765	TS	16	24	16	24	The figure description should also explain what the orange, red and black area corresponds to.	Noted.
31365	TS	16	4	16	4	Isn't carbon removed from the atmosphere not only by the oceans, but also land/vegetation	Accepted. Language has been changed.
20744	TS	16	5	16	8	Increasing harvested wood products stock is also negative emissions. And it is technologically easier and has more reality compare to CCS.	Noted. But we are reporting here mainly on what is currently represented in scenario models, which is largely afforestation and BECCS.
28759	TS	16	7	16	7	The wording suggests that CDR technologies are already at hand - please reformulate, e.g.:"...but there m i g h t also a r i s e other Carbon Dioxide Removal (CDR) options…"	Noted. We highlight the uncertainties on availability and scale of CDR technologies in the final draft, but did so in the SOD version as well.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34729	TS	16	8	16	8	Should add one sentence here about the viability (uncertainties and risks) related to negative emissions, so that that a reader would understand the key difference between available and tested mitigation technologies and the largely untested and/or speculative CDR options. It could for example use a sentence from chapter 6, page 20, lines 24-26: "It is important to realize that the availability of BECCS is uncertain, largely because of constraints with respect to the use of CCS (both technical and societal) and biomass supply."	Noted. Just to highlight that this sentence is part of a later section of the TS.
32268	TS	16	1	16	22	On CDR and BECCS, see commenrts 2& 4 above.	Noted.
21422	TS	16	1	16	10	Suggest including a brief discussion of what substitutes for fossil fuels are currently available and practical to support the scenarios of stabilizing GHG concentrations at 450 ppm.	Accepted. While we highlighted this in the SOD version of TS as well later on, we now clarify immediately the uncertainty about availability and scale of CDR technologies.
20038	TS	16	24		27	Replace descriptions of "Figure TS.7." with those of "Figure 6.7" of chapter 6 (p.20 line 10-15) and insert Table 6.1 of chapter 6 (p.19 line 7-18) somewhere appropriate (as commented above) to be consistent with chapter 6, as firstly different scenario categories were not sorted " according to atmospheric CO2 concentration stabilization levels", secondly the levels of "CO2 concentration" in 2010 given after the scenario categories in parenthesis are not "stabilization levels", and the discussions are made in GHG concentrations in the main text (p.15 line 38-48).	Accepted. Figure TS.7 has been completely re-drafted. A table similar to Table 6.1 of SOD has been added.
30708	TS	17				Add "per year" to "Billion tons of CO2" on the Y-axis of both panels.	Noted. The figure has been removed from the draft.
29118	TS	17				Confusing. Some additional explanation of figure might help, e.g. 'For example, the lowest emissions are seen/modelled where, while higher emissions scenarios…'	Noted. The figure has been removed from the draft.
29119	TS	17				The categories in TS.8 are inconsistent with those in TS.7.	Noted. The figure has been removed from the draft.
34732	TS	17	13	17	21	It should be clarified here that emissions in the figure refer to energy related CO2 emissions (only). This one can find out from the underlying chapter (16).	Noted. The figure has been removed from the draft.
31367	TS	17	14			Suggest to use Gt CO2 in stead of billion tons.	Noted. The figure has been removed from the draft.
39060	TS	17	14			Clarification is needed in the caption and titles of both panels in this figure. The values shows in the historical line (black) are clearly energy CO2 numbers and NOT all GHG numbers. So the panel titles should not be in units of CO2e (but rather CO2) and the caption should clearly state that this only reflects energy CO2 - 60.7% of global GHG emissions, according to Fig. 1.3	Noted. The figure has been removed from the draft.
39061	TS	17	14			This graph needs more explanation - what are "kyoto forcing," "total forcing"?	Noted. The figure has been removed from the draft.
28768	TS	17	14	17	14	The titles of figure (a) and (b) say "CO2-e", but the title of the vertical axis says "CO2". Is this correct? See also our comments on this fig. in the SPM.	Noted. The figure has been removed from the draft.
30707	TS	17	15	17	21	Line 15: Add "annual" to "Near-term Global Emissions". Line 21: Recommend adding an explanation of the "Range for Cancun Agreement" depicted in the Figure to ensure the caption and Figure together are fully comprehensible.	Noted. The figure has been removed from the draft.
28769	TS	17	15	17	15	Figure TS.8 is really hard to understand. I suggest taking out all colored dots and just contrasting the range for Cancun Agreement with the ranges for 450 and 550 ppm. Maybe the latter ranges can somehow indicate where the largest share of scenarios lie.	Noted. The figure has been removed from the draft.
19969	TS	17	3	17	4	The pledges of the Cancun Agreements represent a wide range from BAU emissions till emissions as low as possible consistent with 550 ppm CO2eq. I think it is not a robust statement that the Cancun Agreement is consistent with 550 ppm CO2eq, as this would imply that BAU emissions are consistent with 550 ppm CO2eq. In general I think it all depends on the assumptions made beyond 2020, to make a statement like this, and therefore I would avoid this in the TS	Noted. We have removed this finding.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22894	TS	17	3	17	12	IT SHOULD BE NOTED that Cancun agreement is also compatible with much higher emission pathways.	Rejected. The scientific literature on the pledges exclusively focusses on baseline and low stabilization scenarios. Moreover, it is cleat that if a pathway is consistent with a lower stabilization level, it will be compatible with a higher one.
39057	TS	17	3	17	12	Define or clarify "not-to-exceed" and "overshoot" scenarios	Accepted.
39058	TS	17	3	17	12	The point made here should be coordinated with discussions about "co-benefits" in policy assessment and decision making discussed in the rest of the Summary.	Rejected. We do not see a clear link provided through the literature for this.
28766	TS	17	3	17	12	How about Durban and Doha? Please consider the current state of pledges up to the literature cut off date of WGIII.	Accepted.
39059	TS	17	4	17	4	Should clarify what are "negative emission technologies" and give an example or two.	Accepted.
34731	TS	17	5	17	8	The sentence here is quite complicated. It could be followed with a sentence that simplies the message. For example: "In other words, if emission reductions by 2020 only meet the Cancun mitigation pledges and no more, negative emissions become necessary, in light of the 450 ppm stabilization scenarios assessed."	Accepted. We have revised the finding and tried to simplify the language in this course.
28767	TS	17	7			Please use language that makes sense to outsiders. "not-to-exceed-scenario" is not such an expression, "no-overshoot" would be more useful.	Noted.
30706	TS	17	8	17	10	The sentence beginning with "The Cancun range..." is unclear, especially the phrase "delay constraints". The important point to make is that the Cancun range is only compatible with a 450 ppm CO2-e target in scenarios that employ overshoot with negative emissions technologies, but under those conditions, is consistent with either full or delayed participation.	Accepted. We have revised the finding and tried to simplify the language.
28770	TS	17	24	17	24	"Because there is more time required to reach 550ppm" - would it not be more logical to say: Because there will be more time to reach 550ppm ?	Noted.
21423	TS	17	3	17	12	Suggest listing out what "negative emission technologies" are currently available and practical, or anything that has the potential to develop into "negative emission technologies".	Noted. We have made a general statement about the availability of CDR technologies. At the scale required in the scenarios all technologies will be very uncertain.
20039	TS	17	13		21	Delete the descriptions and plotted points for Kyoto gas and forcing, as Kyoto gas concentrations and forcings are not comparable with the other description and points in GHG concentrations and forcings.	Noted. The figure has been removed from the draft.
20040	TS	17	13		21	Delete the descriptions and plotted points for Category 0 from panel (a) and those for Category 2 from panel (b) to avoid bias, as it seems 450ppm goal is out of Category 0 and 550ppm goal is out of Category 2 according to Table 6.1 of chapter 6 (p.19) .	Noted. The figure has been removed from the draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25569	TS	18				There are lots of co-benefits opportunities between climate change mitigation and air pollution measures. For example, emission reduction of black carbon will cause co-benefit of climate change mitigation and health impacts mitigations. However, trade-off relationships also exist. For example, emission reduction of SOx will cause temperature increase while air pollution is mitigated. Energy security issues are also the same. Imported fossil fuel reductions will cause climate change mitigation and increase energy security. However, the fuel shift from domestic coal to imported natural gas will cause climate change mitigation but will decrease energy security. There are complex relationships. Figure TS.9 is only one case study. For example, K. Akimoto, F. Sano, A. Hayashi, T. Homma, J. Oda, K. Wada, M. Nagashima, K. Tokushige and T. Tomoda, "Consistent assessments of pathways toward sustainable development and climate stabilization," Natural Resource Forum 36(4), 231-244 (2012) indicates such a complex trade-offs by country/region regarding energy security etc. IPCC should not depend on the conclusion by a single paper. Other estimates should also be touched upon.	Noted. A more comprehensive treatment of co-benefits and adverse side effects follows later in the document.
30710	TS	18				The triangular schematics are unclear - reviewing and revising this diagram is recommended. At minimum, suggest adding the acronyms to the X-axis so readers know for sure what these are in the triangular schematics. The caption as is does not explain these sufficiently well to make them readily understood by readers. The fact that they are positioned above the y-axis is confusing.	Accepted. We have completedly re-drawn this figure to make it easier to understand for readers.
31167	TS	18				last sentence of caption mentions pink circles, but there are not any in the figure	Noted.
24156	TS	18		18		Please delete the figure due to the above reason.	Rejected. We see problems with the figure related to its complexity. Nevertheless it carries an important message and we have opted to revise it fundamentally.
23160	TS	18				What do the the circles with plus signs or crosses inside indicate?	Noted. We have completedly re-drawn this figure to make it easier to understand for readers.
21463	TS	18				This figure is difficult to understand. The meaning of the triangles at the top of the figure is not clear at all. The abbreviations (CC, ES, PH) are also not clear. CC is probably climate change? The message is not clear. How much cheaper do energy security and air pollution action become with stricter climate policy? E.g. strict climate policy (bar 3) would costs around 0.8% of GDP. Meeting both energy security and air pollution objectives would increase costs to around 1.1%. However, meeting strict energy security and air pollution separately would cost around 0.2 and 0.6% of GDP, or 0.8% in total. With strict climate policy the additional costs to meet energy security and air pollution are only 0.3%, that is around 0.5% lower. Or something similar.	Accepted. We have completedly re-drawn this figure to make it easier to understand for readers.
22852	TS	18				I am very sorry, but I do not understand this figure, this is too complicated for me.	Accepted. We have completedly re-drawn this figure to make it easier to understand for readers.
29120	TS	18				What are the pink circles doing here exactly? Are they showing costs caluclated according to four (which?) scenarios, as a different approach to using the 600+ scenarios used for the coloured bars? And why?	Noted. We have completedly re-drawn this figure to make it easier to understand for readers.
28771	TS	18	1			What is the time frame of the "significant overlap"?	Noted. This finding as such does no longer exist after revisions.
28772	TS	18	10			Please add e.g. in the parenthesis "(e.g., energy security/air pollution)"	Noted.
39062	TS	18	13			A clearer description in the text would help - is it saying we should first set climate change policy and then work on energy security and air pollution? Or is it showing that if you add the left three columns they would be much greater than the 4th column?	Accepted. We have revised the finding to make the language clearer.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39063	TS	18	13			This figure needs better explanation - what are the triangles on top? What is "ensemble"? There is no "pink circles" as they read. Define "ES" and "PH". Define the shades of blue.	Accepted. There is a new figure now with a carefully worded caption.
28773	TS	18	13	18	13	Abbreviation ES and PH should be added to headline.	Noted. The key finding has been revised substantially.
28775	TS	18	13	19	4	Legend for figure should be phrased in a simpler way. Sentences are too long. E.g. the bracket in line 16-17 could be a new sentence so as not to disrupt the flow of reading ("For the colored bars, policy costs are derived from an ensemble of more than 600 scenarios and represent the net financial requirements over and above baseline energy system development, which itself is estimated at 2.1% of globally aggregated GDP. Financial requirements include cumulative discounted energy-system and pollution-control investments, variable costs, and operations and maintenance costs"). Also the legend should be fully on the same page as the figure. See also our comments on this fig in the SPM.	Accepted. We have revised figure and caption.
28776	TS	18	14	18	14	A definition what is meant by "energy sustainability" would be useful.	Noted.
24155	TS	18	5	19	4	Economic co-benefit is missing in this paragraph. So, please add an integration of sustainability policy with climate mitigation actions by referring to the following literature;. MORIMOTO, NGUYEN, CHIHARA, HONDA and YAMAMOTO; Journal of Life Cycle Assessment, Japan, Vol.2 No.4 October 2006 "Proposals for Classification and an Environmental Impact Evaluation Method for Eco-Services: Case study of Municipal Waste Treatment in Cement Production".	Rejected. A more comprehensive discussion of co-benefits and adverse side-effects follows in later sections. This finding focuses on the literature from integrated assessmenet models.
22895	TS	18	5	19	4	DELETE this para and figure as it is single sided. Adverse side effects, including ecomic costs of CC policy, must be mentioned and it is done well in p21 line 4-5 and p21 line 32-39.	Rejected. This is one line of evidence found in the literature on multi-objective studies in integrated models. This paragraphs summarizes the findings from this emerging branch. Later on other parts of the literature are treated as the comment indicates. This seems appropriate.
21464	TS	18	5	18	5	This downplays the co-benefits of climate policies. High confidence can be stated about climate policies as entry points for achieving a broader set of non-climate objectives.	Rejected. This paragraph focuses on summarizing the findings from multi-objective studies in integrated models. This is an emerging literature.Other more specific studies often do not allow for such general statements.
22418	TS	18	5	18	12	Though climate policy could provide and entry point to achieve a broader set of non-climate objectives, overinvestment in climate change mitigation may cause a severe damage to well-beings of current and future generation if investments into such issues as epidemics, food, anti-terrorisms, etc would be reduced significantly as a result of applying climate policy. In this sense, these risks should be clearly indicated in this section and following sentence should be added at the end of this section: "However, exaggerated emphasis on climate policy would risk global sustainability."	Rejected. This is one line of evidence found in the literature on multi-objective studies in integrated models. This paragraphs summarizes the findings from this emerging branch. Later on other parts of the literature are treated as the comment indicates. This seems appropriate.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40898	TS	18	5	18	12	DELETE this paragraph and figure as it is single sided. Adverse side effects, including economic costs of CC policy, have to be mentioned like in p21 line 4-5 and p21 line 32-39.	Rejected. This is one line of evidence found in the literature on multi-objective studies in integrated models. This paragraphs summarizes the findings from this emerging branch. Later on other parts of the literature are treated as the comment indicates. This seems appropriate.
28774	TS	18	13	18	19	Figure TS.9: What does the symbol - cross within circle - mean?	Noted. We have completedly re-drawn this figure to make it easier to understand for readers.
28777	TS	18	19	18	19	Fig. TS.9. caption - the figure contains no "pink circles"; also figures as such is very complex and subtext seems to be addressed to readers, who are already very familiar with the topic - esp. regarding the explanation of the triangular schematics. The table needs more explanations.	Accepted. We have completedly re-drawn this figure to make it easier to understand for readers.
32269	TS	18				The reasons why the pink circles locate different positions in the bars (one on the top, 2 in the middle and one near the bottom) should be explained.	Accepted. We have revised finding and figure completely.
30709	TS	18	18	18	19	After the phrase “estimated at 2.1% of aggregated GDP”, it may be prudent to insert the actual level. Having a number such as 2.1% could be viewed as big or small, whereas having the actual $ level provides better context.	Rejected. There are different levels of confidence associated with different models outputs. We are more confident about growth rates and relative shares than about the absolut levels, which are more uncertain and should not be reported in the summary documents.
23161	TS	19				What evidence is there for the very large biofuel, solar and wind supplies? Why are there two sets of estimates and uncertainties for each technology?	Rejected. This is a comprehensive synthesis of scenarios submitted by the community for consideration in the Workiung Group III AR5 assessment.
29121	TS	19				The key has errors and is hard to interpret. Given above comment what does category 1 refer to in this diagram?	Accepted. We have revised figure and caption.
39064	TS	19	21			It is unclear what this figure is trying to depict. The caption mentions the green arrow, but never defines the red arrows. I think the caption means to say the boxes of the box and whisker plots are the 25th-75th percentile, rather than the "bars", but it's not clear. Is it significant that one of the red arrows goes outside of the plot space? How do the arrows relate to the box and whisker plots?	Accepted. We have revised figure and caption.
39065	TS	19	21			This is a graph hard to follow. Suggest a more user-friendly way to convey the message.	Accepted. We have revised figure and caption.
28779	TS	19	21	19	26	Message of the Figure is unclear. What is shown in left and right panel? What do the blue and red boxes denote? Confusion between bars and arrows in the caption. The sentence on p 20, l 1-3 does not help.	Accepted. We have revised figure and caption.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22896	TS	19	27	20	4	DELETE, as it is wrong. Many scenarios point to energy efficincy as th near term option (-2030), and then decarbonization of electricty (-2070), and CCS etc later. See, for example, Global Envrionemntal Asssessment chater 17 has a sceanrio "GEA-efficiency" in which effficiency improvement is near term actions and power secto actions come later. Generally speaking, IAMs does not have precision to predict the timing of measures with confidence. SUGGESTION: Replace this para by much more robust finding that "Less GHG pathways are compatible with more electrifiaion in end use sectors"of Chapter 7 Fig 7.18.and p61 line 28-33. Also, see ch6 page 31 line 23 through 25: "the contribution of energy intensity reductions outweighs the contribution of decarbonisation of energy supply by 2030", "an initial focus on energy reductions and increasing focus on fuel switching over time"(ch6 p 31 line 33-34) and "electrification of end use sectors is a way fo reducing GGH emissions" ch6 p 31 line 45-47.	Rejected. We agree with the general comment, but it does not stand in contradiction to this finding. In fact, this point is highlighted later on in the TS.
22897	TS	19	27	20	4	DELETE, as it is wrong and provides bad messages to policy makers. Too much focus on near term decarbonization of electricity may results in biased policy making of diffusion of immature and costly technologies by regulations and subsidies, resulting in high power price and hinder the electrification that is necessary for long term deep emission cuts.	Rejected. The literature shows that the decarbonization of energy is required for achieving ambitious long-term concentration targets such as 450 or 550 ppm co2eq. Unless we decarbonise energy, we cannot meet such targets. This finding talks in a sense about a pre-condition for electrification.
40899	TS	19	27	19	29	DELETE, as it is wrong. Many scenarios point to energy efficiency as the near term option (-2030), and then decarbonization of electricity (-2070), and CCS etc. later. See, for example, Global Environmental Assessment Chapter 17 has a scenario "GEA-efficiency" in which efficiency improvement is near term actions and power sector actions come later. Generally speaking, IAMs does not have precision to predict the timing of measures with confidence. SUGGESTION: Replace this paragraph by much more robust finding that "Less GHG pathways are compatible with more electrification in end use sectors"of Chapter 7 Fig 7.18.and p61 line 28-33. Also, see ch6 page 31 line 23 through 25: "the contribution of energy intensity reductions outweighs the contribution of decarbonization of energy supply by 2030", "an initial focus on energy reductions and increasing focus on fuel switching over time"(ch6 p 31 line 33-34) and "electrification of end use sectors is a way of reducing GGH emissions" ch6 p 31 line 45-47.	Rejected. We agree with the general comment, but it does not stand in contradiction to this finding. In fact, this point is highlighted later on in the TS.
28780	TS	19	30			How about 2020? Information should be added.	Rejected. 2030 is typically reported in the literature.
19140	TS	19	5	21	2	This is not chapter 1 , but the TechnicalSummary.Tech. and economic requirements of long-term mitigation scenarios. To achieve 450 or 550 ppm of CO2equiv will require a considerable use of biomass. Yet Fig. TS1 downplays the use of biomass for electrical generation without BECCS. As mentioned above, the cost and the promotion of CCS with CO2 storage from biomass may be farm more expensive than without storage. about 15-20% of the energy has to be used in the transport and storage process.	Rejected. It is unclear which Figure the reviewer is referring to. But we note the points on the use of biomass without CCS and the energy requirements of transport and storage.
28778	TS	19	6	19	20	Para can be shortened, contains quite some duplications, e.g. on co-benefits.	Accepted. We have revised this finding substantially.
21465	TS	19	7			"portfolio choices will depend on local circumstances and economic conditions, including linkages.."	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22389	TS	19	5	22	7	There should be a statement in this section that highlights the limitations of the models and assumptions used. It could be along the lines of: "However, the models and assumptions stated above should be considered with care given the inherent limitations of the scenario models used as discussed in Sections 6.2.1, 6.2.3, and 6.2.4 of Chapter 6."	Rejected. We do not think it is appropriate to do so at this particular point. However, we have added a box summarizing key aspects of these models and their limitations.
23162	TS	20				The scatter of future points is so broad no conclusion can be drawn.	Rejected. We do not share this view, but have dropped this figure from the TS for different reasons.
25433	TS	20				Need to reference figure in text.	Noted. Figure removed for final draft of TS.
39068	TS	20		20		Somewhere during the discussion of the costs of mitigation, refer to the estimate costs that will likely be incurred if the world continues along its current "business as usual" path. A good range can be found in the Stern Report and its various critiques. It is VERY important to note that we will either "pay now" for cleaner energy or "pay later" to try and live in a damaged environment. The "pay now" costs are more certain. The "pay later" costs are more uncertain, but may also be much higher than the "pay now" option.	Rejected. This is an important point. But the "pay later" costs for living in a damaged environment are mainly treated in Working Group II. It will be a main challenge for the SYR to bring these type of information together.
28783	TS	20	10			Please explain "cumulative macroeconimc costs"	Noted.Relevant text in the final draft TS does not use this concept.
39067	TS	20	14	20	14	Give an example or two of "economic costs"	Rejected. The cost estimates are presented later.
28784	TS	20	16		8	Please explain "residual emissions"	Noted. We have avoided this language in the final draft TS.
40901	TS	20	18	20	20	Discount rate would give large effects onto the estimated cost. However, the uncertainty in discount rate is rather large. Therefore, please add some other information of 1% discount rate and 10% discount rate to cover the uncertainty. Such an explanation should be added to SPM as well.	Rejected. This is what this text exactly does. It highlights that costs reduce by up to a factor of four when a discount rate of 8% is used and double to triple when a discount rate of 1% is used.
29122	TS	20	18	20	18	For the non-economist an explanation of discount rate in this context would be beneficial.	Rejected. There is an entire box on discounting. We agree that this should be referenced in the text.
28785	TS	20	19	20	20	Is the discount rate in % per year?	Accepted. Reference to Box on discounting will be added, where this is explained.
30375	TS	20	21	20	29	This paragraph hints at potential adverse consequences of some mitigation options but I think there should be a clearer signal of these - the headline statement in bold should explicitly point out "However there may be adverse side effects of some mitigation options necessary to achieve these targets".	Rejected. This is an important point, which is highlighted in the TS, but is not the focus of this finding.
30711	TS	20	21	20	32	Box TS.7 is not referenced in the document. This paragraph would seem an appropriate place to provide a reference to Box TS.7. The Box is a useful addition to the TS.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23718	TS	20	21		32	Thus, we would also recommend omitting lines 21-32 on page 20 of the Technical Summary, which reports the same numbers from section 6.3.6. Furthermore, on page 20, line 25, you undermine the validity of the economic results anyway by calling the mitigation scenarios both “idealized” and “notional”. In addition, a technical basis for not reporting the “less than 4%” result is that the result is not described properly as the cumulative present value impact on GDP over 85 or 90 years in 2100 (if that is correct), implying an average annual impact on GDP much less than 0.1%, which is both well within the error bars of being able to actually measure GDP in the first place, and it is far less than other likely costs and benefits of mitigating climate change that are omitted from most if not all IAMs, such as transaction costs. (See below for other examples of the problems with calculating this economic result.) Furthermore, the “net cost” designation (where, strangely, no model runs show “net benefits”) does not even net out the incremental economic and ecological damages from climate change, making the way in which the results are reported even more potentially confusing to readers, since including net damages would almost certainly reverse the 4% net costs into a high net benefit result given recent damage trends. Remember that many of the earlier climate change mitigation studies such as the Stern Review at least attempted to indicate roughly how net damage costs would cancel the net costs of mitigation. The models included in the database that is promised should be analyzed as to whether this net cost vs. net benefit orientation is intrinsic to each model, or not, due to its structure and optimization methodology. If the net cost results of 4% are left in the report, or whatever the final number is according to the methodology used in Chapter 6, a discussion must be presented of why there are no “net benefit” results shown in any of the figures in Chapter 6, e.g. in Figures 6.20, 6.21, 6.22, and 6.23. Again, is this because of the way in which each IAM optimizes the baseline case for each baseline/mitigation pair of scenarios, implying that if the baseline case is at equilibrium, there is always a net cost in going from the baseline equilibrium to the mitigation scenario model solution? If true, this would imply that there is a built-in bias in all IAM model structures that mitigation always implies a net cost as opposed to net benefits, as some model critiques have claimed. More likely, if a wider range of cost inputs such as higher fossil-fuel prices had been run in some reference scenarios, net economic benefits would have resulted for mitigation scenarios in relation to those alternative reference scenarios. Note that in the WGIII report for the Fourth Climate Assessment there were at least some net benefit results reported from IAMs in Figure 3.25. The change between the two assessments needs to be explained if any net costs results are reported in the Fifth Assessment report. If there is a bias in the model structures, it should be revealed. Another major reason why we think the net cost results should be removed from the SPM, the TS (Technical Summary), and Chapter 6 is because the modeling community should certainly not attribute “medium confidence” to these results as stated on SPM, page 10, line 3 and TS, page 20, line23. Personally, we think scientists should have “no confidence” in these economic results due to the deep uncertainties inherent in all the major input assumptions and components of the calculations by IAMs. This would be a more honest and “balanced” view, which is key for IPCC reports. In addition to the excellent list of types of uncertainty that appears on TS page 15, lines 3-37, we would add the inherent uncertainty in both the overall model structure and the basic form of the equations used to model each major sector of the economy (e.g. sectoral production functions). Finally, since we will never know which was the appropriate reference case (from the very wide variety of baseline scenarios as depicted in Figure 6.1, page 14 of Chapter 6) to compare the mitigation scenario to in order to derive the net cost differences, you should explicitly cite which reference case and which specific mitigation scenari	Reject. The scenarios reviewed here are from cost effectiveness models, which do not consider the benefits of mitigation, i.e. Avoided climate damages. This is treated in Working Group II. It will be a key issue of the synthesis report to put bring these two lines of evidence together.
22898	TS	20	21	20	32	Replace "under the most advantageous conditions" by "under the most idealistic conditions".	Noted.
34734	TS	20	21	20	25	These two sentences on estimated macroeconomic costs should be followed immediately with a sentence saying that this estimation represents just costs, and doesn't take into account the important co-benefits that come with mitigation action, or the economic value of avoided climate impacts. This is very important and should not be left to the text box alone (TS.7)!	Rejected. The point on co-benefits are prominently made in the TS. It seems more appropriate to the authors to keep each finding focussed,

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22727	TS	20	21		32	Thus, we would also recommend omitting lines 21-32 on page 20 of the Technical Summary, which reports the same numbers from section 6.3.6. Furthermore, on page 20, line 25, you undermine the validity of the economic results anyway by calling the mitigation scenarios both “idealized” and “notional”. In addition, a technical basis for not reporting the “less than 4%” result is that the result is not described properly as the cumulative present value impact on GDP over 85 or 90 years in 2100 (if that is correct), implying an average annual impact on GDP much less than 0.1%, which is both well within the error bars of being able to actually measure GDP in the first place, and it is far less than other likely costs and benefits of mitigating climate change that are omitted from most if not all IAMs, such as transaction costs. (See below for other examples of the problems with calculating this economic result.) Furthermore, the “net cost” designation (where, strangely, no model runs show “net benefits”) does not even net out the incremental economic and ecological damages from climate change, making the way in which the results are reported even more potentially confusing to readers, since including net damages would almost certainly reverse the 4% net costs into a high net benefit result given recent damage trends. Remember that many of the earlier climate change mitigation studies such as the Stern Review at least attempted to indicate roughly how net damage costs would cancel the net costs of mitigation. The models included in the database that is promised should be analyzed as to whether this net cost vs. net benefit orientation is intrinsic to each model, or not, due to its structure and optimization methodology. If the net cost results of 4% are left in the report, or whatever the final number is according to the methodology used in Chapter 6, a discussion must be presented of why there are no “net benefit” results shown in any of the figures in Chapter 6, e.g. in Figures 6.20, 6.21, 6.22, and 6.23. Again, is this because of the way in which each IAM optimizes the baseline case for each baseline/mitigation pair of scenarios, implying that if the baseline case is at equilibrium, there is always a net cost in going from the baseline equilibrium to the mitigation scenario model solution? If true, this would imply that there is a built-in bias in all IAM model structures that mitigation always implies a net cost as opposed to net benefits, as some model critiques have claimed. More likely, if a wider range of cost inputs such as higher fossil-fuel prices had been run in some reference scenarios, net economic benefits would have resulted for mitigation scenarios in relation to those alternative reference scenarios. Note that in the WGIII report for the Fourth Climate Assessment there were at least some net benefit results reported from IAMs in Figure 3.25. The change between the two assessments needs to be explained if any net costs results are reported in the Fifth Assessment report. If there is a bias in the model structures, it should be revealed. Another major reason why we think the net cost results should be removed from the SPM, the TS (Technical Summary), and Chapter 6 is because the modeling community should certainly not attribute “medium confidence” to these results as stated on SPM, page 10, line 3 and TS, page 20, line23. Personally, we think scientists should have “no confidence” in these economic results due to the deep uncertainties inherent in all the major input assumptions and components of the calculations by IAMs. This would be a more honest and “balanced” view, which is key for IPCC reports. In addition to the excellent list of types of uncertainty that appears on TS page 15, lines 3-37, we would add the inherent uncertainty in both the overall model structure and the basic form of the equations used to model each major sector of the economy (e.g. sectoral production functions). Finally, since we will never know which was the appropriate reference case (from the very wide variety of baseline scenarios as depicted in Figure 6.1, page 14 of Chapter 6) to compare the mitigation scenario to in order to derive the net cost differences, you should explicitly cite which reference case and which specific mitigation scenari	Reject. The scenarios reviewed here are from cost effectiveness models, which do not consider the benefits of mitigation, i.e. Avoided climate damages. This is treated in Working Group II. It will be a key issue of the synthesis report to put bring these two lines of evidence together.
25050	TS	20	21	20	21	Replace "advantageous" by "the most idealized".	Noted.
40903	TS	20	21			In order to discuss GDP loss, the premises/assumptions (discount rate, costs of technology deployment, socioeconomic scenario used, etc.) for estimations should be explained, and the comparison with damage costs is needed. If such information is absent or ill-provided, policy decisions on actions/inactions and their scale cannot be made.	Rejected. Key assumptions are treated in various boxes throughout the TS. Damage costs are mainly the realm of Working Group II. It is an important purpose of the synthesis report to bring these two lines of evidence together.
40902	TS	20	21	20	21	Please change the expression "most advantageous condition" to "idealistic condition"	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28786	TS	20	21	20	24	How can both GDP and personal consumption reduction be 4%? Please give more explanations. Please give reductions also in terms of US$, as on p 23, last para.	Noted. These are estimates of macro-economic costs from different types of models. We have made this clearer in the final draft of the TS.
28787	TS	20	21	20	24	To balance the statement that costs will be 1/2 to 2/3 lower for the 550ppm goal please add "This decrease in costs, however, comes at the expense of considerably higher climate change costs" or something along those lines.	Rejected. Damage costs are mainly the realm of Working Group II. It is an important purpose of the synthesis report to bring these two lines of evidence together.
28788	TS	20	21	20	24	What does the "4%" refer to? What is the timeframe? Are these cumulative reductions or per year?	Noted. We have tried to have clearer text in the final draft of the TS.
28789	TS	20	22	20	22	The reference of GDP is not clear (as for time and origin). Does this mean that resources in the amount of less than 4 % of worldwide yearly GDP are necessary?	Noted. Yes, but we decided to present only the full ranges in the new version of the TS as estimates vary widely.
30712	TS	20	23	20	23	Is this meant to be 4% from baselines projections?	Noted. These are global macroeconomic losses relative to baseline. We have clarified the language.
21467	TS	20	23	20	23	The text "less than 4%" should be replaced by an exact reference to the range offered in Figure TS.12. The range is between 0.8 and 3% GDP loss up to 2050. This excludes the studies that need to be added which indicate negative costs in terms of GDP loss in the case of unemployment (see e.g. Knopf et al. (2009): The economics of low stabilisation: implications for technological change and policy. In: Making Climate Change Work for Us, Cambridge University Press) and comments on Chapter 6. Missing studies need to be included in the text.	Accepted. We present the full cost ranges in the final draft of the TS. The indicated scenarios with negative costs have not been submitted to the AR5 database. However, they are covered in the broader discussion of chapter 6.
34733	TS	20	23	20	23	Given that cumulative macroeconomic costs are "extraordinarily hard to estimate", as outlined in the preceding paragraph, it would seem more appropriate to present the whole range (for estimated mitigation costs in an optimised situation) rather than just one number. So "1.1-3.9 %" (as in the underlying chapter 6, page 39) instead of "less than 4 %".	Accepted. We present full ranges in the final draft of TS.
28790	TS	20	23	20	23	As many models have produced other cost estimations (see line 31-32) better a range of costs should be given here ("GDP or personal consumption in the range of 4 - x %). Moreover costs should be (additionally) estimated with an discount rate of e. g. 4 % (as Integrated Assessment Models typically use discount rates in the range of 3-5 %; see p. 23, line 13).	Accepted. We present full ranges in the final draft of TS.
28781	TS	20	3	20	4	Sentence unclear.	Noted.
21468	TS	20	31	20	32	This sentence should be deleted. It is not clear which levels are meant. 4% GDP loss? But that is the maximum in Figure TS.12 so the upper limit! Text needs to be added to say that cost could also be overestimated, e.g. because population or GDP growth may be lower than expected, energy savings higher, behavioural change can occur such as food shift that improve health or technological change is underestimated because of faster learning by doing or learning by searching.	Accepted. After presenting the full range in cost estimates, this sentence is no longer required.
39066	TS	20	5			Key message of this figure should be made more clear.	Accepted. Figure has been removed.
28782	TS	20	5	20	8	Message of the Figure is unclear. Explain color coding in figure caption as well as "direct equivalent", "final energy use", "cost-minimization profile over the near term" and the blue crosses. What is "Baseline" (BAU, reference)? Currently, fig TS.111 is not mentioned in the text. Either refer it or delete.	Accepted. Figure has been removed.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32599	TS	20	9		20	This could be a place to elaborate more on some of the structural uncertainties in modeling but two more fundamental points could also usefully be brough out around here. One is to clarify that model baselines are Assumed in almost all cases to be optimal, though in fact they are more extrapolations of non-optimal business as usual. Second, differences in the baselines are hugely important and frequenly more important than actual mitigation scenarios/cost assumptions - a point well made in AR4. I worry here we are going backwards. If any evidence is wanted, just consider the variations in GDP baselines of the EMF-22 studies: the loss of as result of CO2 constraints is trivial in comparison with the underlying GDP ranges, all of which imply getting a lot richer globally. Third, that implies that we have choices to shape how the future evolves, within which things like good governance, investment stability, innovation, avoidance of possible resource traps etc are all likely to be more important than whhether or not we have high carbon. Finally, the issues are to do with tansition management and we know that major technological transitions are notoriously difficult to cost. See Grubb et al. (2013) Planetary Economics, chapter 10 on these points, with EMF data illustrated in context also of growth and innovation theories in Chapter 11.	Noted. These are very good points, which we have kept in mind while revising the summaries.
21466	TS	20	9	20	20	It might better to first give a range for the costs, before giving the relative change due to the assumption about the discount rate. Otherwise one doesn't know if a 5% increase is much or only minor.	Accepted. We have integrated these two aspects in one finding in the final draft of the TS.
22840	TS	20	9		20	I would first give a range for the costs, before giving the relativ change due to the assumption about the discount rate. Otherwise one doesn't know if a 5% increase is much or only minor.	Accepted. We have integrated these two aspects in one finding in the final draft of the TS.
40900	TS	20	9	20	20	The pre-conditions to achieve the scenario is important. please maintain this paragraph.	Noted.
32270	TS	20	9	20	20	It is useful to discuss the consequences of choosing different discount rate. It should also be clearly mentioned that the costs of policy measures deployed later in the century such as BECCS can be very significantly underestimated if exchange rate of 5% or bigger is chozen.	Taken into account - this is done at the end of this paragraph.
20041	TS	20	21			Replace "advantageous" with "economically efficient", as "advantageous" is too vague.	Noted. We have revised this finding comprehensively.
20042	TS	20	23			Add description correspond to "An important caveat to this result is that it does not account for a potential sampling bias due to the fact that high cost models may have reported pathways towards low stabilization targets to a lesser degree." (Chapter 6 p.39 line2- 4), as this is new and extremely important finding.	Noted. This is covered in chapter 6.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21469	TS	21				The figure is incomplete. Essential references to other model studies are missing. The IPCC is charged with providing the world with a clear scientific view of the current state of knowledge on climate change. This chapter omits results from a number of studies on costs of climate change despite stating that an exhaustive database of all studies has been created. The costs of mitigation are estimated using AR5 scenarios and a set of selected CGE and partial-GE models, and is not based on available literature. Employment effects are omitted and no papers on green growth are included. Papers referenced but results are not considered and discussed: Van Vuuren D. et al. (2009): Comparison of top-down and bottom-up estimates of sectoral and regional greenhouse gas emission reduction potentials. Energy Policy 37, 5125–5139. (DOI: 16/j.enpol.2009.07.024); Edenhofer, O. et al. (2010): The Economics of Low Stabilization: Model Comparison of Mitigation Strategies and Costs. Energy Journal Special Issue on "The Economics of Low Stabilisation", pp.11- 48; Knopf, B. et al. (2009): The economics of low stabilisation: implications for technological change and policy. In: Making climate change work for us. Cambridge University Press, Cambridge; Aaheim A., J.S. Fuglestvedt, and O. Godal (2006): Costs savings of a flexible multi-gas climate policy. The Energy Journal 27, 485–502; Leimbach, M. et al. (2010): Mitigation costs in a globalized world: climate policy analysis with REMIND-R. Environmental Modeling and Assessment 15, 155–173. Papers not in references and results are not considered: Guivarch , C., et al. (2011): The costs of climate policies in a second-best world with labour market imperfections,□Climate Policy,11, 1; Goodstein, E. (2011): Reconciling the science and economics of climate change, Climatic Change, 106, 4, pp 661-665 DOI: 10.1007/s10584-011-0039-3; Rogelj, J. et al. (2013): Probabilistic cost estimates for climate change mitigation, Nature, 493, 79–83, doi:10.1038/nature11787; Ackerman, F. and Stanton, E. A. (2012): Climate Risks and Carbon Prices: Revising the Social Cost of Carbon, Vol. 6, 2012-10, http://dx.doi.org/10.5018/economics-ejournal.ja.2012-10; Magne et al. (2010): Technology Options for Low Stabilization Pathways with MERGE. Energy Journal 31 (Special Issue 1): 83–108; Ackerman, F. et al. (2009): Limitations of integrated assessment models of climate change. Clim Change 95(3–4), 297–315. there is nothing on limitations of the chosen models in chapter 6, however a critique on low cost estimates by Tavoni and Tol, 2010 is present);Alkemade, F. and Hekkert, M. (2010), Nature, Vol. 468, 7326.	Accepted. We will provide the full ranges in Figure 12. It is not possible to collect scenario information from pulished studies only. Much more comprehensive underlying information is required. This is why there was a broad call for scenario submission to the community. In general, the database with its more than 1200 scenarios is representative for the published literature since AR4 on long-ter, scenarios. Where not, this needs to be added in the discussion in the chapter.
29123	TS	21				This diagram is complex and difficult to interpret. Can the explanation be improved or the dgram simplified to illustrate the point more clearly.	Accepted. This figure has been substantially revised.
25025	TS	21	1	21	33	This section provided a much more useful discussion of future mitigation costs than in the SPM. Suggest that this section could be replicated in the SPM.	Rejected. The limited space of the SPM does not allow for such a comprehensive treatment. Macro-economic costs are only one aspect of transformation pathways and more uncertain than others.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34735	TS	21	1	21	10	This is a very important text box! It should be placed after the line 33 on page 21, as it relates as much to the paragraph that is on lines 21-33 than it refers to the paragraph that is on page 20, lines 21-32. It could be complemented with two things: 1) Including a key message from the underlying chapter 6: Although measures of macro-economic costs have often been put forward as key deliberative decision-making factors, these are far from the only characteristics about transformation pathways that matter for making good decisions. Decision-makers will also need to consider other national and societal priorities, such as energy and food security, sustainable development, the distribution of economic costs, local air pollution, and other environmental factors and co-benefits associated with different technolocy choices, and economic competitiveness. 2) Giving a sense of the scale of possible co-benefits (that go unaccounted), by acknowledging that for individual countries, the economic value of air quality co-benefits alone can be of similar order of magnitude than climate mitigation costs (see Ch6, p66, lines 31-39). Now the examples of scale are buried in the end of the chapter.	Accepted - text revised.
28791	TS	21	1	21	10	Box TS.7: Very promising title, but please simplify and do not use jargon. Is "aggregate macroeconomic costs" equal to cumulative macroeconomic costs" (expression used in text). There seem to be some duplications in the box. Please explain the relevative significance of the constraints mentioned and their effects on the results (e.g. costs of mitigation options). In addition, the box does not help understanding Fig TS.12: how do "global mitigation costs of idealized implementation scenarios" refer to the costs explained in box TS.7? The indicators presented in Fig TS.12 (consumption loss, GDP loss, abatement cost, net present value costs) should be explained in the Box TS.7	Accepted - text revised.
39069	TS	21	11			The figure is hard to read. Key message is not clear.	Accepted. This figure has been substantially revised.
28792	TS	21	11	21	20	The legend should not cut out part of the figure, and there is no need to print it twice for left and right panel. The numbers at the x-axis are too small. More information on the categories is needed in a box, as the categories are used in many places in the TS. More information is also needed on what a "general equilibrium model" and a "partial equilibrium model" - in a box on model concepts.	Accepted. Figure and caption have been revised.
21470	TS	21	18	21	19	Why does one model report costs higher than 6%. For which period? 2015-2100?	Noted. Figure and caption have been revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34736	TS	21	21	21	33	Would be more accurate to say "by up to 4 times" of orders of magnitude, rather than "by four times". In addition, it doesn't seem justified to lump all the different cases into options with "broadly pessimistic assumptions about technology", given that there is one scenario that contains optimistic assumptions about renewables and energy efficiency - and the added costs of which remain on much more moderate level than that 4 times of orders of magnitude. Knowing that the cost estimation doesn't include co-benefits (of accelerated uptake of RE and EE and exclusion of CCS and nuclear), the the true cost increase, caused by exclusion of certain technologies, may be even much, much lower. The EERE case would merit to be considered in a separate paragraph. Elsewhere in the WGIII report, a strong case is made in favor of ambitious energy efficiency measures, because they come with multiple benefits AND reduce costs of mitigation. For example in Chapter 6, page 42, on lines 7-9 it reads: "Demand-side technologies demonstrate an important influence on the costs of mitigation. For example, in EMF27, reductions in the energy intensity pathway led to substantial reductions in the costs of mitigation."This seems to show in the figure TS.13 too, in how more increased energy efficiency compensates for increased macroeconomic costs of excluding nuclear & CCS. If I read the figure TS.13 correctly, for the 450 ppm case, the median impact of the EERE case is about 1 order of magnitude, not 4. This would indeed suggest that the para on lines 21-33 is misleading. I highly recommend intepreting the different cases (of limited technology availability) separately, and not lumping them together. Elaborating more on the option with more ambitious energy efficiency & RE measures would seem justified also in light of the points made elsewhere in this Technical Summary, that most integrated studies don't recognise large remaining opportunities for net profit energy efficiency potential, which bottom-up studies do recognise (page 30) and that IAMs also see much lower rates of energy intensity improvements for vehicles (page 34, line 18).	Rejected. This is a misunderstanding. "by four times to orders of magnitudes" describes a range that is derived from an analysis of a large number of scenarios. Co-benefits are dealt with in a seperate section. Note that we also do not include other cost components as they are not reported by the models or highly uncertain. For this reason there is a box on macro-economic costs also in the final version of the TS. The point on EERE is noted.
21471	TS	21	27	21	33	The text is biased towards pessimistic assumptions that increase costs. Needs to be balanced with optimistic assumptions: population stabilises earlier at a lower level, energy efficiency is faster, behaviour changes etc. carbon sinks increase because of temperature increases etc.	Rejected. The text first discusses idealised scenarios, where there is a global carbon price immediately and all technologies are available at full scale. Subsequently, cost implications of cases are discussed where technology portfolios are limited or there is no global carbon price initially.
28793	TS	21	31			Models "could not produce" some scenarios: This information is only useful, if information about the models is available. As it stands, it does not much sense. Please add a box on model concepts, limitations and uncertainties.	Rejected. We agree that this must be more carefully discussed as in chapter 6. However, the failure of models to solve the optimisation problem subject to a particular set of constraints can be interpreted as an indicator for greater difficulty in the ability of the global society to meet a certain long-term target or a higher risk of not meeting the target.
25601	TS	21	34	22	4	These should be kept.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34737	TS	21	34	22	7	This is a very important paragraph, but the bolded text could be a bit more reflective of what's in the actual para: by delaying action, we locking ourselves into a situation where we are dependent on a technology that may not be feasible after all, or could be very challenging to implement - and come with negative impacts for biodiversity, livelihoods, food production, water resources, and cultural values, coupled with risks related to the permance of CCS and related governance and liability complexities.	Noted.
40904	TS	21	34	21	37	It is a very important finding that "450 ppm CO2-eq scenarios increasingly depend on net negative emissions (e.g., BECCS) in the second half of the century". Please maintain this part. Furthermore, feasibility of such technologies should be further analyzed.	Noted.
28794	TS	21	34	21	35	It is repeated many times in the the TS (and SPM) that negative emissions might be needed in case of delayed action. This is not balanced. In addition, there are currently no technologies available to remove GHG from the atmosphere. This should more emphasized.	Rejected. This is a central result of the analysis of post AR4 scenarios on low stabilization. Even with an immediate global carbon price and a full technology portfolio, many scenarios have high shares of afforestation and BECCS. It is highlighted clearly that availability and scale of these technologies are highly uncertain.
28795	TS	21	34	21	35	Please qualify this statement with regard to the assumed path of economic growth: "450 ppm CO2eq scenarios with continued economic growth increasingly depend on net negative emissions (e.g. BECCS) in the second half of the 21st century - particularly in the case of delayed mitigation."	Noted. We have revised this finding comprehensively.
20831	TS	21	37	22	5	Good text, and this text should be kept. There are several barriers to introduce CCS and BECCS.	Noted.
24469	TS	21	37	22	5	I agree this desciption. It is very important.	Noted.
25654	TS	21	37	22	4	This part should be kept in the final version report because it is uncertain whether BECCS can be utilized in the future. Safety confirmation, affordability and public acceptance are indispensable in CCS site selection. There is a much higher barrier to adopt BECCS than CCS because BECCS requires stable biomass supply for generation at reasonable cost. Since feasibility for BECCS has not been established so far, it is not appropriate to expect huge potential for BECCS in the future, as described in (Rhodes, 2008, page323). This literature is listed in the No7 line of this table.	Noted. The spirit of this section has been kept, but the finding has been comrpehensively revised.#
32454	TS	21	37	22	4	It should be remained since the uncertainity of BECCS are mentioned	Noted.
30376	TS	21	39	22	1	Also mention potential negative effects of bioenergy on deforestation regarding ecosystems and biodiversity	Noted.
32271	TS	21	21	21	33	same as above. In addition it is necessary to discuss the availability (and its uncertainty) of BECCS as huge amount of CDR appears to rely on BECCS in the scenarios produced to meet the 450ppm target.	Noted.
30713	TS	21	18	21	19	After the phrase “substantially higher costs than 6%”, it may be prudent to insert the actual level. Having the actual $ level provides better context. It may also be prudent to provide a range of actual costs in addition to the % range.	Accepted. We have revised the entire figure and show full ranges.
20043	TS	21	29			Replace "to the same degree" with "several fold" to make it consistent with section 6 (p.6 line 27).	Notes. Findings has been fundamentally revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29730	TS	21 of 59	21		39	The bulk of this paragraph seems to justify/normalize using advanced technologies (now) for mitigating, but omits the scenario in which solutions are based on GHG reductions at source and the use of decentralized existing local technologies. At line 37, please retain, but as BOLDED: "The availability of BECCS as a mitigation option must be considered uncertain, largely because of constraints with respect to the use of CCS (both technical and societal) and biomass supply." Given the uncertainty, the prominence of BECCS in the SOD,in general, and the reliance on BECCS in the stabilization scenarios, specifically, are not justified.	Rejected. More than 1000 scenarios have been collected of which many deal with ambitious mitigation goals. These scenarios highlight the role of BECCS as does the underlying scenario literature. Not highlighting this would mean not being truthful to the literature. It is very important to highlight the maturity of this technology, the scale suggested in the scenarios and the risks. We are doing a careful assessment based on the published literature.
25602	TS	22				See comment No.5.	Rejected. Not clear what is meant with this comment.
22854	TS	22				The figure has far too many details. The model numbers can be skipped without loosing any information.	Accepted. This figure has been comprehensively revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32465	TS	22				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	This comment is missing reviewer information.
28800	TS	22		22		Figure may be difficult to understand as readers are not always familiar with box plots. Explain the diagram. In addition, a title to the legend at the right (e.g. models) would help to understand its meaning.	Accepted. This figures has been substantially revised.
29124	TS	22				Reproduction of this diagram is poor and labels can not be read. An improved explanation of the point this diagram illustrates would be beneficial.	Accepted. This figures has been substantially revised and produced with higher quality.
28799	TS	22	19	23		Box TS.8 The discount rate is already discussed in boxes TS.1 and TS.2. The information given in lines 27-31 is duplicated. Where does the box end? What are "normative" and "positive" perspectives? What is the "Ramsey Rule" (add to glossary)? Why would investment increase intergenerational inequality?	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39070	TS	22	2	22	6	The question is not whether bioenergy will be reconciled with other uses... it already exists and is competing in the marketplace, so they will be. The question is what tradeoffs are made (either in reduced mitigation, reduced other services, or innovation, planning and creativity that limits these tradeoffs). Also, Lock in effects can go both ways... if we don't invest in the current, non-CCS, bioenergy systems and sustainability, we could lockout the future net negative BECCS systems that will be necessary to meet ambitious CC goals.	Noted. We reject the first half of the comment as scenarios project a substantial upscaling in bioenergy. We will consider the second half of this comment in our revisions.
25026	TS	22	20	23	18	(Box TS.8). The discussion of the significance of discount rates in estimation of future costs and benefits of climate response is critically important. Suggest this needs to be kept in the event of shortening the TS. Suggest however that this Box needs to more clearly reflect the costs of allowing climate change to occur. In that sense, this analysis looks at the net costs of mitigation action, presumably including a carbon price as a (very inadequate) proxy for the cost of failure to act. Alternately, it highlights the need for improved explanation of how the costs of climate change are incorporated into the modelling work discussed here. More discussion of the role of stronger innovation in mitigation and its impacts on costs could be useful. Strong innovation could significantly reduce the future carbon price while achieving the same concentration of CO2. Suggested citation: Garnaut, R. (2011). Update Paper 1: Weighing the costs and benefits of climate change action. Garnaut Climate Change Review Update 2011, released 3 February 2011 (http://www.garnautreview.org.au/update-2011/update-papers/up1-key-points.html)	Accepted - separate box on benefits of mitigation was added.
28796	TS	22	4			Add information on the significance of the uncertainty (IPCC language)	Noted.
41073	TS	22	5	22	7	Fossil fuels with CCS is arguably better, in the short term, than renewables, though I guess what is meant with the current wording is that the prospect of CCS developing further might remove the incentive to move away from fossils fuels. However, such a move away from fossil fuels might not be feasible at scale in the short term (e.g. in China). I don't see why CCS should delay other energy sources, unless the intent is to imply that dropping fossil fuel use (with CCS) would cause sufficient collapse of energy supplies that alternatives would become higher priority? "Fossil fuels" skips the benfits of fuel-switching from coal to gas, and "Lock-in" implies permanence. I'd prefer: "Another challenge is unduly prolonging the the use of fossil fuels (with or without fuel switching from coal to gas) in anticipation of large-scale CCS development." This wording implies/assumes that there would be viable large-scale alternatives.	Rejected: There are results from structured multi-model experiments, which clearly shows this fossil-fuel lock-.in effect.
22424	TS	22	8	22	17	I suppose all the scenarios in the AR5 set some limitations on nuclear capacity and thus adverse effects of no-nuclear option becomes relatively small. This should be cleary indicated in the footnote.	Rejected. Some of the scenarios have very high shares of nuclear. Not having nucelar does not affect costs severely, because there are various technologies that could replace it.
39071	TS	22	8			It is very difficult to read the green and blue letters around the box and whisker plots. The acronyms or names in the far right panel are never defined.	Accepted. This figure has been revised and produced with higher quality.
39072	TS	22	8			Not easy to process this information. Is this a good graph to present?	Accepted. This figure has been revised to be more accessible to the reader.
28797	TS	22	8	22	8	Please add an explanation for the scenarios LowEI, NoCCS, NucOff, Lim SW and LimBio. See also our comments on this figure in the SPM.	Accepted. This is not self explanatory.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28798	TS	22	8	23	11	Please explain the difference between the two ranges (1-7% and 0-8%). I imagine that many literature cases show discount rates of 1-7% and almost all of them discount rates of 0-8%.	Noted. We are not quite clear, which cost range the comment is referring to. On the figure the cost range shown is between 0-4%.
32273	TS	22				not only the case of 1% and 7% but 5% should be presented to show the magnitude of the influence of discount rate since 5% is a defact choice in many estimates/scenarios.	Rejected - due to space constraints it is difficult to give more examples.
32272	TS	22	1	22	7	Quantitative discussion should be made on CCS and BECCS to indicate the potential availability, costs and uncertainty.	Noted.
19508	TS	23	10			It is not clear that the discount rate ranges provided in the text are sufficiently supported by the discussion in Chapter 3.	Accepted - text revised.
28802	TS	23	11			What does "risk premium" mean?	Accepted - text revised.
28803	TS	23	17			What does "marginal costs" mean?	Accepted - text revised.
39074	TS	23	19			It seems as if the colors are reversed in the caption. Shouldn't blue identify decreasing policy costs. The colors of the dots within the plot are never defined. In general, it is difficult for the reader to understand what the key message(s) are from this figure.	Figure has been removed from TS.
28805	TS	23	19	23	19	Why are there no scenarios where international climate policy covers more then 50% of the emissions?	Figure has been removed from TS.
28804	TS	23	19	23	25	What does the figure show? Add a short indication at the beginning of the caption. What are "global policy costs" (not mentioned in Box TS.7). What is the unit of the y-axis? Why do the dots have different colors? The red and blue colors are not needed, this is too much information and it is clear without. The last sentence of the caption is not clear for non-experts - please simplify and do not use jargon. The CP2 of the Kyoto Protocol covers about 15% of the global emissions, the figure starts only at 20% - please start at 10% to be more policy relevant. This figure does not use the categories, and discusses higher stabilization scenarios - why is that? Why do costs increase with increasing cooperation for a given reduction target?	Figure has been removed from TS.
34738	TS	23	26	23	27	Why the word "most" in this bolded sentence? Are there stabilization scenarios that would be compatible with current investment patterns?	Noted.
28806	TS	23	26	23	33	Again: Uncertainty must be indicated.	Accepted.
29125	TS	23	26	23	27	The headline appears to be policy prescriptive. As a minimum, can we change "need to change" to "would need to be changed"	Accepted. This statement could be seen as prescriptive and needs to be adjusted.
20832	TS	23	27	23	30	When we consider "with limited incremental net investment", improving the generation efficiency of coal power is effective. It should be added.	Rejected. This comment does not focus on specific options at this detail. Many other options would need to be highlighted. We need to stay here on the macro level.
34739	TS	23	27	23	30	the redirection of investments in the energy sector could be expected to shift more to power plant & transmission efficiency & smart grid technology too.	Rejected. This is not a consideration that comes from the scenarios.
28807	TS	23	27	23	30	The statement is a generalization which should not stay like this and should be deleted. Why should climate policy be expected to increase nuclear and fossil fuel /CCS? This ignores phasing out of nuclear in many countries and the risks and barriers associated with CCS. You also forget to explain, that a no-nuc-scenario would be possible for no extra investment costs as SPM.7 shows.	Reject. This is not about the particular view of governments on specific technologies. It is a synthesis of the scientific literature on investment in cost-optimizing long-term scenarios. Note that there are also countries in Europe planning to expand their nuclear capacities.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28808	TS	23	29	23	30	What are "limited incremental net investment needs"?	Noted. This needs to be clarified.
39075	TS	23	31	23	33	Needs a reference to current investment scale to understand the relative increase needed to meet these goals. Without a reference value, these numbers are somewhat meaningless.	Noted
32211	TS	23	6	23	6	explain shortly what is Ramsey rule	Accepted - text revised.
39073	TS	23	8	23	12	The conclusion on discount rate ranges does not reflect the range of views in Ch. 3 or in the broader literature, and they are also so wide (0-8%)as to not be useful for policymakers.	Accepted - text revised.
30714	TS	23	9	23	11	These lines (presenting ranges for implied social discount rates) are rather awkward to read. These are not two separate findings, but different ranges depending on how much confidence is expressed in the range. Suggest picking just one range to report in the TS or split into two separate sentences.	Accepted - text revised.
28801	TS	23	9			What kind of "selection"? Which criterion guided this selection?	Accepted - text revised.
26294	TS	23	19	23	25	there is no explanation in the graph of the number of dots in each category. Are they the number of model samples?	Figure has been removed from TS.
20044	TS	23	19		25	Explain how many models produced scenarios out of how many models participated for each case, as this is new and extremely important finding.	Figure has been removed from TS.
20045	TS	23	26			Replace "in order to become" with "if they were to become" to be consistent with SPM (p.11line 9)	Accepted. This statement could be seen as prescriptive and needs to be adjusted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32466	TS	24				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	Noted.
21472	TS	24	1	24	2	Please replace "dramatically" with "significantly". Are we not talking about substantial delays since we do not have pledges on the table already but these are not sufficient (yet) to move us towards a 2-degree path.	Noted. We understand from this review that this "delay" language as found in the scientific literature is confusing to policymakers. We therefore have focussed on emission levels in 2030 for discussing transition dynamics. It seems less important what exactly causes these levels.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39076	TS	24	1	24	6	It is not delays in international cooperation that increase costs... it is delays in global mitigation investment. Each nation could act independently, and if the total scale of investment was sufficient, the lack of cooperation wouldn't matter at all.	Accepted. We understand that this language is not clear. Delay in international cooperation in this context essentially means the absence of a global price.
28809	TS	24	1	24	6	The heading of this section talks about delays in international cooperation as a significant factor. The following text then discusses delays in mitigation efforts as a significant factor. The figure TS.14 shows costs in relation to the CO2 emissions covered by the international climate policy. In summary I think this section mixes up the effects of delays in action in general and the effects of insufficient international climate policy. I suggest talking about these things separately or at least explaining their connection.	Noted. We understand that as it was it may confuse the reader and have revised the entire approach to this issue - which focusses now on emission levels in 2030 and subsequent transition processes. The figure has been removed from TS.
28810	TS	24	1	24	6	Use more neutral language (words like "dramatic" are not appropriate for IPCC). Add information on uncertainty.	Accepted.
39079	TS	24	10	24	11	Why is discussion only focused on "caps" and regulatory solutions? What about incentive policies (carbon taxes, etc.)	Rejected. The discussion focusses on the model assumptions - here the carbon price. The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
20834	TS	24	12	24	14	Carbon tax is partly effective. However, its rate should be decided under various situations of each country, such as GDP, energy-supply system. Whether "prominent" or not depends on these situations, so this word should be deleted.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
28811	TS	24	14	24	20	Does this mean that models are not realistic? Are the results not relevant for policy makers? Reformulating of this para is suggested.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
39080	TS	24	17	24	20	How does this square with experiences, such as the US Clean Air Act cap-and-trade for NOx and SOx, or the Montral Protocol for CFCs, where predicted costs far exceeded the actual realized costs?	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
21473	TS	24	19	24	19	All true but there are elements that we underestimate: speed of behavioural change and technical progress. This needs a more balanced text.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40906	TS	24	21	24	22	The sentence discussed about the difference between model study and real world. This is very important from the view point of "realistic discussion". Therefore, please maintain it .	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
40907	TS	24	21	24	35	Generally the results induced by such simulations have large dependency on their model structure and pre-conditions (i.e. assumption for calculation). Therefore, please describe about it also in SPM to avoid blind faith onto the simulation results.	The author team decided to dissolve this entire section in the revision following this government and expert review.
20197	TS	24	24	24	31	It is unclear what is meant by 'weak' in line 29. The role of intellectual property in providing incentives for innovation is overstated (see comment 14 above). Competition, reverse engineering and imitation are critical to promote innovation and diffusion, as proven by the technological development of today advanced countries. Most countries in the world currently apply the high standards of protection mandated by the TRIPS Agreement; hence, the prevailing model of intellectual property cannot be qualified as 'weak'. In addition, the incentive effect of intellectual property is context-dependent. A 'strong' protection will not lead to any significant R&D outcome in countries with low R&D capability, low industrial development and scarcity of risk capital, as shown by the case of many countries that apply TRIPS-plus standards, such as Mexico, Colombia, Peru, Morocco, Bahrein. The statement in the TS seems to reflect a dogmatic view; in order to effectively promote innovation and diffusion and array of measures need to be considered. Focusing on a 'strong' intellectual property regime will also make a disservice to the international community; such a regime will not ensure that the needed innovation AND diffusion takes place on a global scale. In some cases, 'strong' rights may deter innovation. See generally on the subject, Carlos Correa, 'Innovation and Technology Transfer of Environmentally Sound Technologies: The Need to Engage into a Substantive Debate', Review of European Community & International Environmental Law, Volume 22, Issue 1, April 2013.	The author team decided to dissolve this entire section in the revision following this government and expert review.
21474	TS	24	29	24	30	Where is the evidence for the high transaction costs? Delete "very". It is also risky to do nothing which is also likely to affect the original drivers (GDP, population, energy use etc).	The author team decided to dissolve this entire section in the revision following this government and expert review.
28812	TS	24	33	24	35	Does this mean that models are not realistic? Are the results not relevant for policy makers? Reformulating of this para is suggested.	The author team decided to dissolve this entire section in the revision following this government and expert review.
25027	TS	24	36	24	48	This section highlights the assumptions underlying the models used to estimate future costs of mitigation. The assumption that we are already 'efficient' is a major one and Australian examples such as the Energy Efficiency Opportunities program and surveys by AIG show clearly that industry in Australia falls well short of economically rational action. EEO firms are saving over 8% of energy at a carbon cost of minus $98/tonne, while the AIG surveys show most businesses have not pursued energy efficiency (there may be more recent results) and they found many multiple benefits. The 2012 EREP report Victoria's Environmental Resource Efficiency Program) found that participants were saving $90 million each year on energy with an average of less than one year payback period. Clearly, results like these are not included in the modelling discussed in this section, but are critically important in reducing the cost of abatement. This issue is discussed briefly in text on page 30, but it needs to be emphasised and the resulting conservatism of the modelling results presented emphasised.	The author team decided to dissolve this entire section in the revision following this government and expert review.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28813	TS	24	36	24	48	A reference to the importance of taking into account the different backgrounds of "diverse groups in a population, with respect to age, level of schooling, activities, lifestyles, and culture" (taken from Ch. 3, p. 93, line 42-43) in the TS might be helpful for policy makers.	The author team decided to dissolve this entire section in the revision following this government and expert review.
21475	TS	24	46	24	48	There is also evidence (see this AR5 draft) that preferences can change in the other direction: less meat, other modes of transport (walk, cycle, use public transport, eat less meat, fly less) that need. Either balanced or the sentence should be deleted.	The author team decided to dissolve this entire section in the revision following this government and expert review.
28814	TS	24	46	24	46	Does this mean that models are not realistic? Are the results not relevant for policy makers? Reformulating of this para is suggested.	The author team decided to dissolve this entire section in the revision following this government and expert review.
28815	TS	24	46	24	46	In order to make clear that the diffusion of information might not be the only way to salvation add the following sentence from Ch. 3 (p. 89, line 5-7) after "...models in use". Add: "However, a critical issue is whether such interventions are appropriate substitutes for carbon taxes (e.g. in terms of environmental and cost-effectiveness)."	The author team decided to dissolve this entire section in the revision following this government and expert review.
39077	TS	24	7	27	20	This entire section (TS.3.4) is much too long given the conclusions and lack of particular support from underlying text.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
22390	TS	24	7	25	25	There should be a statement in this section that highlights the limitations of the models and assumptions used. It could be along the lines of: "However, the models and assumptions stated above should be considered with care given the inherent limitations of the scenario models used as discussed in Sections 6.2.1, 6.2.3, and 6.2.4 of Chapter 6."	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
39078	TS	24	8	24	35	It is not clear where in Sec. 1.3 this text is located. The authors should revise to more clearly link the TS text to that from the underlying chapter to ensure accurate and representative messaging is brought forward.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
40905	TS	24	8	24	9	This realistic discussion should be kept.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
20833	TS	24	9	24	11	Regarding policies to reduce GHG emission, in addition to technology regulations and caps, we should put emphasize on transferring such technology and voluntary approach. Policies should encourage them.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.
22419	TS	24	9	24	11	Please add ", labelling" after "regulations" in the sentence "Mitigation can be encouraged by various forms of policy interventions, such as technology regulations or caps on emissions" so as to describe variations of policy interventions.	The author team decided to dissolve the first four key findings of this section in the revision of the TS following the government and expert review.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20046	TS	24	1		6	Add description correspond to the two sentences: "Indeed, many integrated models cannot produce scenarios that meet a concentration of 450 ppm CO2eq by 2100 even with overshoot when there is a delay in global mitigation efforts or delays by a large component of the world's emissions (e.g. ,the OECD countries or the non-OECD countries) beyond 2030" of SPM (p.10 line 28-31); and "And model failures can bias results in important ways, for example, the costs of mitigation, because only those models producing scenarios can provide estimated costs." of Chapter 6 (p.13 line14-16), as these are new and extremely important findings.	Noted. This finding was completely re-vised in the new TS draft.
23720	TS	25		26		Omit both Figures TS-15 and TS-16, because regional-specific results for the net costs of mitigation are far more uncertain than even the global results.	Accepted. We have removed figures on regional costs of mitigation even though we see a value in having them.
25434	TS	25				Put countries in same order on figure legend and caption. Need y-axis title.	This figure has been removed from the TS.
22729	TS	25		26		Omit both Figures TS-15 and TS-16, because regional-specific results for the net costs of mitigation are far more uncertain than even the global results.	This figure has been removed from the TS.
39081	TS	25	1	25	14	It is not clear where in Sec. 1.3 this text is located. The authors should revise to more clearly link the TS text to that from the underlying chapter to ensure that accurate and representative messaging is brought forward.	Noted. The finding has been removed for the final version of the TS.
39082	TS	25	1	25	14	This paragraph should be reorganized for clarity. It jumps from effort sharing institutions to the size of the carbon market and its relation to global mitigation reduction. What specifically about global mitigation is the size of the carbon market related to? The cost of mitigation? The effort?	Noted. The finding has been removed for the final version of the TS.
40908	TS	25	10	25	14	The IPCC should not evaluate actual UNFCCC negotiations but be based on social science research. Therefore, "The last two decade of diplomacy under the UNFCCC have demonstrated that creating global institutions for mitigating climate change is difficult.[?]Diplomatic history as well as" should be omitted to make the sentence read: Social science research also suggests that international institutions relevant to climate change mitigation will be decentralized and fragmented rather than tightly integrated around a single least-cost global optimum	Noted. The finding has been removed for the final version of the TS.
28816	TS	25	15	25	16	The text refers to figure TS.15, but this part of the text speaks about costs, while the figure shows relative mitigation effort and not mitigation costs. I think this is misleading.	Accepted.
21476	TS	25	20	25	20	Why are OECD costs lower? Higher GDP? Lower CO2/GDP? Lower energy-GDP?	Accepted. This finding has been revised for clarity.
40909	TS	25	22	25	23	This is also a realistic discussion. Please maintain it.	Noted
28817	TS	25	25	25	26	Please add a title for the vertical axis. Please consider adding a legend for the colors than explaining it in the text or remove colors.	This figure has been removed from the TS.
28818	TS	25	25	25	26	Remove "optimal", this is policy prescriptive. Is " BAU" equal to "baseline"? Whiskers are not explained. 2 panels, one for 2050 and one for 2100 would be of advantage. If not: x-axis should show first the results for 2050 and then for 2100, going further into the future each time.	This figure has been removed from the TS.
39083	TS	25	26			The lighter colors are very difficult to see. While they are supposed to be lighter than the other data points, they need to be more saturated.	This figure has been removed from the TS.
39084	TS	25	26			Reference to "50%" and "100%" reduction unclear. 50% and 100% from what?	This figure has been removed from the TS.
29126	TS	25	4	25	5	Marginally policy prescriptive. Suggested change - "For instance" to "In the idealised scenario setting". This would also make this paragraph compatible with the following (Line 18).	Noted. We have considered this in the redrafting

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26295	TS	25	19	25	22	it could be desirable to have an explanation why costs of mitigation will be lower in OECD countries. In the "average" perception (and this is the assumption behind CDM mechanism), developing countries face lower mitigation costs because high industrialised countries have already made progress in efficiency.	Noted. The reason is that future emission growth will mainly take place in non-OECD countries and the size of the effort will therefore be larger. As highlighted in subsequent findings, this does not imply anything about who should bear the costs. This is a different matter.
30230	TS	25		27		[related to my comment on Section 6.3.6.6] It is important to emphasize uncertainties in the regional distribution of mitigation costs. Uncertainties in regional mitigation costs tend to be larger than uncertainties about costs on the global level. Domestic mitigation costs depend on many factors, such as assumptions about regional GDP, energy demand, technological mitigation options (e.g. RE potential, CCS potential), fossil resource endowments,... Financial transfers in the context of a global cap-and-trade regime depend not only on the burden sharing scheme, but also critically on CO2 prices. These are highly uncertain, and depend critically on the stringency of climate targets, technology porfolios, and structural model assumptions. It would be helpful to derive implications for the design of international burden sharing schemes.	Noted.
21477	TS	26	1			It is not relevant to maintain a firewall perspective in the discussion about the distribution of efforts (text below TS.16) when Figure TS.16 shows that different distribution of total effort affects specific (developing) countries in diverse ways.	Noted. We do not quite understand what the comment hints at, but we will try to relfect it in revisions.
39085	TS	26	1			The dots in the plot are defined by acronyms, but those acronyms are never defined. What do those colors mean in terms of policy costs?	This figure has been removed from the TS.
39086	TS	26	1			Proper legend to each country. What consitutes "policy costs"? In which year(s)?	This figure has been removed from the TS.
31368	TS	26	12	26	12	EITs synonymous to REFs?	Accepted
29127	TS	26	15	26	15	reference to EIT's or REF's is inconsistent.	Accepted
23505	TS	26	18	27	12	The beneficiary pays principle is also often discussed in the literature as an important principle, see e.g. Page, E.A., 2012. Give it up for climate change: A defence of the beneficiary pays principle. International Theory, 4 (2), 300-330 and Grasso, M., 2012. Sharing the emission budget. Political Studies, 60 (3), 668-686	Noted.
28819	TS	26	2	26	2	What is the timeframe for these costs. Are these cumulative costs? Also, what is the rationale behind "GDP shares" - why should rich countries be allowed to emit more? See comments in SPM on this fig.	This figure has been removed from the TS.
39088	TS	26	21	26	23	It's unclear what is meant by "stringent to 'early' emitters". Can the authors please clarify?	This finding has been revised for clarity and brevity.
39089	TS	26	29	26	30	This is a half-developed statement. From what baseline is this 25-40% reduction from? And what is required of major emerging nations under this scenario? Would the reductions by the developed world alone get us on that pathway? No. What would be required of the developign world? And do these nubemrs still hold even thoguh they are from AR4? The authors should cite more recent literature as, frankly - much of the analysis done for AR4 is now obsolete given the dual impacts of the global recession on A1 emissions and the continued, unprecedented rate of increase in NA1 emissions.	This aspect is no longer part of the final TS version.
28820	TS	26	29	26	33	What is the timeframe for the stated emission reductions of 25-40%?	This aspect is no longer part of the final TS version.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39090	TS	26	30	26	33	This is not a fully-developed statement. Would this solve the problem? What is required of major emerging economies under this scenario? What do other studies show? To selectively choose studies that solely focus on emissions reductions from the developed world does a dis-service to the policymakers reading this report as it does not relay the necessity of action from ALL major emitters to solve the problem.	This aspect is no longer part of the final TS version.
28821	TS	26	30			Delete ref to RCP, this is not done elsewhere in the TS.	Rejected. We have tried to link more closely to the RCP language in the revision of the TS.
39087	TS	26	6	26	33	The two paragraphs convey related points. They are both very long and provide too much details. Should revisit and consider to revise and condense.	Accepted. We have revised these findings for brevity and clarity.
26296	TS	26	23	26	24	Complementary with the above comment; the statement says that "(…)as they capture the mitigation potential in developing countries, which is assumed to be relatively cost effective." This statement matchs better the "average" perception that mitigation costs are lower in developing countries.	Noted. The finding on effort sharing has been revised for clarity and brevity.
20047	TS	26	29		33	Delete the last two sentences in this block if there are not corresponding sentences in chapter 6 or chapter 13 quoted, as I found non, especially the numbers "25-40%".	Accepted.
27285	TS	27		27		In table 6.3, the category "capability" does not only relate to GDP or HDI, but also to other social and economic development indicators.	This table has been removed from the draft.
24418	TS	27				Need more accurate representation for the items to be checked. This table indicates staged approaches satisfy all equity principles, implicitly suggesting this approach would be best one among others. It would be, however, not correct understanding. Staged approaches take all key equity principles into consideration to some extent, but the degree of consideration is not the same with others. For example, in terms of responsibility, "responsibility" and "staged approaches" are checked in the same manner, but the degree of responsibility consideration is not the same. Different check mark should be used to reflect the difference in the degree of consideration.	This table has been removed from the draft.
22391	TS	27		27		The definitions of the various categories of effort sharing proposals needs to be given more detailed, particularly with respect to the methodology for how the chapter authors determined how each of the categories fit or match the equity principles. Furthermore, the source for the various categories also needs to be indicated, as well as the methodology by which the categories were identified.	This table has been removed from the draft.
39091	TS	27	1			The authors should consider not including this table as it inappropriately summarizes complicated concepts better explained in the underlying chapter. Also the caption makes several problematic statements, such as equating all responsiblity and capability on climate change with the phrase CBDR, which is very politically fraught.	This table has been removed from the draft.
28822	TS	27	1	27	11	The text on effort sharing principles should be moved to the main text, and the table should be moved to the SPM.	This table has been removed from the draft.
28824	TS	27	19			It is not only the supply chain but considerable security issues exist at all stages (extraction, use and waste management). Therefore, nuclear a not-practical solution. Please revise your statement.	This finding has disolved for the final draft of the TS-
39092	TS	27	26	27	26	Can we really make this assertion when there are 50% uncertainties in LULUCF emissions and 25+% uncertainties in non-CO2 emissions?	Accepted. Sentence has been reformulated and now refers to the share of different sectoral emissions to the global total. Uncertainties related to the emissions are also explicitely shown in section TS.2 in figure XXX
28823	TS	27	11	27	12	Category "Potential" : in the description a "Tryptich approach (ref)" is mentioned - please give reference where to find an explanation.	This table has been removed from the draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25435	TS	28				Need to reference figure in text.	Accepted. Note however that figure has been changed and moved to section TS.2.
29129	TS	28				Use of different colours and different keys does not help interpretation of this diagram.	Accepted. Figure is being re-worked to improve accessibility.
28825	TS	28	1	28	5	The share of the global GHG emissions of the transport sector in 2010 is indicated with about 13 % in the Technical Summary. Whereas in chapter 8 the share of the global GHG emissions of the transport sector is about one quarter in 2010. Why is there a difference? If the reference regarding "energy related emissions" is the distinction, this should be more clearly communicated, especially for policy makers.	Accepted, these discrepancies are being corrected.
29128	TS	28	1		5	The attribution of greehouse gases to individual sources could be clearer: e.g. the 25% electricity and heat being a subset of the 33% for total energy.	Accepted. A new figure TS.3 has been developed that clearer shows the shares of electricity and heat in the energy sector.
21478	TS	28	12	28	12	Delete "ambitious". This is a value judgment. It is more ambitious to stay on a business-as-usual track in view of the impacts.	Rejected, a qualifier was introduced and now reads 'for more ambitious stabilization goals'
28826	TS	28	2	28	5	Please briefly explain the sectors "energy" and "buildings". What comprises the buildings sector - only direct fossil fuel demand for heating or does it also comprise electrity used for heating, energy used for building, etc.	Accepted. The difference between direct and indirect emissions from electricity is being made.
28828	TS	28	5			Lower panel could be deleted, fig 18 gives similar information, but presentation is better	Rejected. Figure 17 describes baseline emissions, Figure 18 emissions in stabilization scenarios. However, Figure 17 has been re-drawn to improve accessibility.
28829	TS	28	5			Upper panel: The legend and the table in the upper part of the figure are too small. The table needs more explanation, please write out sector names or explain. The text above the figure states a contribution of roughly a quarter from industry, but the figure shows 21.1%, i.e. a fifth only. Lower panel: The label of the y-axis of the lower panel is not correct. The caption in the lower panel says "over time", but should say "for the years 2030, 2050,2100". Information on 2020 is needed also. It might be better to put one sector for the four years (2020, 2030, 2050,2100 in one group and show this for each of the sectors. Both: The upper panel shows AFOLU, the lower Land-use and and non-CO2 GHG: please be consistent. The upper shows CO2e, the lower CO2: please be consistent. It is not necessary to put both figures in one frame. A title with short explanation for each of the figures might be a clearer way, because now the explanation isn't clearly allocatable.	Accepted. Figure has been re-worked to improve accessibility.
28827	TS	28	5	28	6	Data should be checked for consistency: In the transport sector chapter the value of direct GHG emissions from transport is in most cases given with 7.0 Gt CO_2-eq. However, in the TS a calculation of the direct GHG-emission of the transport sector yields a value of about 6.8 Gt CO_2-eq using 13,5 percent of 50,1 Gt CO_2-eq. The value of 6.8 Gt CO_2-eq is taken only in chapter 8 in a FAQ section (section 8/page 14/line 11).	Accepted, these discrepancies are being corrected.
31369	TS	28	6			Suppose that the units on the Y-axis should be CO2-eq, not CO2	Accepted and corrected.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25028	TS	28	6	28	10	It would be useful if the discussion around this graph pointed out that this breakdown is based on point of use emissions from sectors. If electricity emissions were allocated to end use sectors, the buildings sector, noted to be 7%, would be much higher, as over half of electricity is used in buildings. In addition, a substantial proportion of the materials produced are used for building. These points highlight the danger of relying on emission inventories to set policy priorities.	Accepted. The figure has been redesigned to address the difference in direct and indirect emissions.
39093	TS	28	6			In the bottom panel, what do the N= numbers mean?	These numbers refer to the underlying baseline scenarios. This will be clearer stated in the final version of the figure.
39094	TS	28	6			Should point out the lower panel presents *projected* emissions compared to historic emissions in upper panel.	Accepted. The figures have been separated in order to avoid confusion on this important aspect.
28830	TS	28	9	28	9	"The table shows" - what table? Do you refer to one of the figures above?	Accepted. Figure and caption have been redrafted.
26297	TS	28	12	28	13	the sentence states that GHG emissions at the end of the century will be a fraction of current emissions. As 999/1000 and 1/1000 are both fractions, it would be better to say a "small fraction" or other adjective to qualify this "fraction", if it is wanted to mean this.	Accepted, the sentence has been reworded.
31371	TS	29	16	29	22	This is an important aspect, but it is not discussed to a large degree in 6.8. Is reference to another chapter/sub-chapter more appropriate?	Accepted, this specific discussion of cross-sector leakage effects has been removed.
22899	TS	29	16	29	22	KEEP this para as it is important finding for policy makers. Move this para to SPM.	Rejected, this specific discussion of cross-sector leakage effects has been removed.
25051	TS	29	16	29	22	Keep this paragraph and copy-and-paste this onto SPM.	Rejected, this specific discussion of cross-sector leakage effects has been removed.
40911	TS	29	16	29	22	This paragraph, on "interactions between sectors" is important for policy makers… therefore, please write this also in SPM.	Rejected, this specific discussion of cross-sector leakage effects has been removed.
25603	TS	29	17	29	20	This kind of concern should be taken care.	Rejected, this specific discussion of cross-sector leakage effects has been removed.
22420	TS	29	17	29	20	Totally agree.	Rejected, this specific discussion of cross-sector leakage effects has been removed.
31168	TS	29	19	29	19	delete "out" after "without"	Accepted, paragraph has been removed.
22900	TS	29	23	29	29	DELETE, as it is wrong and provides bad messages to policy makers. Too much focus on near term decarbonization of electricity may results in biased policy making of diffusion of immature and costly technologies by regulations and subsidies, resulting in high power price and hinder the electrification that is necessary for long term deep emission cuts.	Accepted, the paragraph has been reworded and the focus on the required interaction between sectors, i.e. the energy demand side, has been sharpened.
40912	TS	29	23	29	24	DELETE, as it is wrong and provides misleading messages to policy makers. Too much focus on near term decarbonization of electricity may result in biased policy making of diffusion of immature and costly technologies ("lock-in" effect) by regulations and subsidies, resulting in high power price and hinder the electrification that is necessary for long term deep emission cuts.	Accepted, the paragraph has been reworded and the focus on the required interaction between sectors, i.e. the energy demand side, has been sharpened.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20835	TS	29	24	29	27	When it comes to energy supply, "environmental conservation", "energy-security", "economy" what we call "3E" should be considered. From this standpoint, it is not clear that reducing GHG in electricity sector is relatively easier. Moreover, in industrialized countries, many technologies are too matured to improve easily. However, some technologies of industrialized countries could be transferred to developing countries with relatively low cost This point should be noticed.	Accepted, the paragraph has been reworded and the focus on the required interaction between sectors, i.e. the energy demand side, has been sharpened. However, the comment on tech and knowledge transfer is rejected as this does not seem the suitable context to raise this important point.
23506	TS	29	26	29	27	Unclear what is meant by "demand sector" - electricity demand vs. electricity generation?	Accepted, the paragraph has been re-written to be clearer on the interaction energy supply and energy demand sectors.
24470	TS	29	27	29	29	Althogh the availability of BECCS must be considered uncertain indicated in the same chapter TS (line 37 of page 21), this description will give rise to misunderstandings that BECCS would be easy cost saving mitigation technology. BECCS has many barriers at the present moment, so it should not be expected yet.	Accepted. A new paragraph that explicitely describes the role of bioenergy and CCS in the land-use sector in stabilization scenarios has been added. The related barriers of BECCS are discussed in the AFOLU sector.
25655	TS	29	27	29	29	This part should explain that it is uncertain whether BECCS can be utilized in the future, as described in the section TS.3.3 (page 21, line 37). Safety confirmation, affordability and public acceptance are indispensable in CCS site selection. There is a much higher barrier to adopt BECCS than CCS because BECCS requires stable biomass supply for generation at reasonable cost. Since feasibility for BECCS has not been established so far, it is not appropriate to expect huge potential for BECCS in the future, as described in (Rhodes, 2008, page323). This literature is listed in the No7 line of this table.	Accepted. A new paragraph that explicitely describes the role of bioenergy and CCS in the land-use sector in stabilization scenarios has been added. The related barriers of BECCS are discussed in the AFOLU sector.
34740	TS	29	27	29	29	The sentence here on the availability BECCS (or other CDR technologies) suggests that they are available and that they help to reduce costs. This seems contradictory to the messages elsewhere in the report, that there are economic, social and environmental challenges and uncertainties related both to CCS and expansion of biomass production.	Accepted. A new paragraph that explicitely describes the role of bioenergy and CCS in the land-use sector in stabilization scenarios has been added. The related barriers of BECCS are discussed in the AFOLU sector.
22425	TS	29	27	29	27	please add following sentense after "demand sectors.": "However, due to barriers like public acceptances, effective measures to reduce emissions in the electricity sector (e.g. nuclear and large hydro) cannot always be introduced, and thus results in an increase in mitigation cost in power sector."	Rejected, the paragraph has been completely reworded.
21479	TS	29	28	29	28	Replace "It further reduces…" with "It could further reduce…". So far BECCS has not been proven and there are also doubts on the sustainability and net effect of storing amounts of carbon underground and the net effects of supplying large amounts of biomass (i.e. on carbon stored in forest soils).	Accepted. A new paragraph that explicitely describes the role of bioenergy and CCS in the land-use sector in stabilization scenarios has been added. The related barriers of BECCS are discussed in the AFOLU sector.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28831	TS	29	3			Exchange the expression "dramatically" with a more neutral expression.	Accepted, the sentence has been reworded.
22901	TS	29	30	29	42	DELETE, as it is wrong. Many scenarios point to energy efficincy as th near term option (-2030), and then decarbonization of electricty (-2070), and CCS etc later. See, for example, Global Envrionemntal Asssessment chater 17 has a sceanrio "GEA-efficiency" in which effficiency improvement is near term actions and power secto actions come later. Generally speaking, IAMs does not have precision to predict the timing of measures with confidence. SUGGESTION: Replace this para by much more robust finding that "Less GHG pathways are compatible with more electrifiaion in end use sectors"of Chapter 7 Fig 7.18.and p61 line 28-33. Also, move the para "TS 29 line 16-22 (a phased strategy must account for interactions between sectors to prevenet unintended consequence" to here in SPM.	Accepted. New text outlines the importance for energy demand reductions in the near-term but also emphasizes the importance of the near-term decarbonization of electricity if low GHG concentration levels are to be reached.
25052	TS	29	30	29	42	Replace "a near-term option" by "an option of all-seasons" and change the following sentences accordingly. Some decarbonization options such as CCS may take more time than currently anticipated, and other options such as PV may not be fiscally sustainable as demonstrated in Europe. Decarbonization of electricity should be consistently seeked as new technology develops and electricity demand increases.	Rejected. However, a new text has been drafted that outlines the importance for energy demand reductions in the near-term but also emphasizes the importance of the near-term decarbonization of electricity if low GHG concentration levels are to be reached.
40913	TS	29	30	29	31	DELETE, as it is wrong. Many scenarios point to energy efficiency as the near term option (-2030), and then decarbonization of electricity (-2070), and CCS etc. later. See, for example, Global Environmental Assessment Chapter 17 has a scenario "GEA-efficiency" in which efficiency improvement is near term actions and power sector actions come later. Generally speaking, IAMs does not have precision to predict the timing of measures with confidence. SUGGESTION: Replace this paragraph by much more robust finding that "Less GHG pathways are compatible with more electrification in end use sectors" of Chapter 7 Fig 7.18.and p61 line 28-33. Also, move the paragraph "TS 29 line 16-22 (a phased strategy must account for interactions between sectors to prevent unintended consequence" to here in SPM.	Accepted. New text outlines the importance for energy demand reductions in the near-term but also emphasizes the importance of the near-term decarbonization of electricity if low GHG concentration levels are to be reached.
28835	TS	29	37	29	39	After "Energy reduction remains valuable for minimizing the need for low-carbon energy supply and if reduced demand can displace fossil supply at the margin" please add "thus providing substantial co-benefits for sustainable development." or something along those lines .	Rejected, but new paragraph notes that the co-benefits of energy demand reductions are larger than those of energy supply measures.
30715	TS	29	4	29	5	The phrase "natural ways" could be interpreted different ways by different people. The text would be clearer here if the language from line 13 were used instead. Suggest revision as follows: Phasing emission reductions over time along low-cost mitigation pathways, across different sectors, and across types of actions, would limit the costs of mitigation.	Accepted, the sentence has been deleted and drafted completely new.
28833	TS	29	4			What does "phase" mean in this context?	The sentence has been reworded.
28832	TS	29	4	29	15	I do not understand in what way the "ways to phase the emphasis of emissions reductions over time" are "natural". Do you mean beneficial or technically feasible?	The sentence has been reworded.
31370	TS	29	6	29	15	Please check chapter reference in this paragraph. This parapraph does not seem to follow from the text in 6.8.	Accepted, paragraph has been reworded to be better backed by the underlying chapter.
28834	TS	29	6	29	8	Sentence not clear. Why "to contain the costs of mitigation,..."? Do you mean to minimize those costs?	Accepted, the paragraph has been reworded.
39095	TS	29	7	29	8	It would be helpful to give examples of "least expensive" and "more expensive" options.	Rejected, the sentence has been completely re-worked.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40910	TS	29	8	29	12	It is very important to avoid the lock-in effect on long-lived infrastructures. So, this part should be maintained. Also, this paragraph can be merged with TS P45L27-30.	Suggestion is rejected, as it does not seem to support the flow of the storyline to merge this with the finding in the AFOLU sector. Instead, a new more general finding on lock-in has been drafted for the cross-sectoral section TS.3.2.1.
29735	TS	29 of 59	27		29	DELETE: "The availability of BECCS (or other CDR technologies) has a substantial effect on this dynamic. It further reduces the cost of emissions reductions, allowing for deeper reductions and an earlier decarbonization of electricity." Because the availability of safe, sustainable BECCS or other CDR technologies is uncertain, the positive impacts of BECCS are also uncertain. This sentence adds nothing substantive, in the interest of space, we recommend deletion.	Accepted. A new paragraph that explicitely describes the role of bioenergy and CCS in the land-use sector in stabilization scenarios has been added. The related barriers of BECCS are discussed in the AFOLU sector.
19632	TS	3		57		of the TS. Since some readers may look only at the TS, I would be valuable to begin with the ES from Chapter 1, and then organize the TS to support these conclusions.	Noted - text revised.
19633	TS	3		57		and then organize the TS to support these conclusions.	Noted - text revised.
19631	TS	3	1	57	38	The Executive Summary of Chapter 1, pages 3 and 4 of Chapter 1, is clearer and more forceful than the findings of the TS.	Noted - text revised.
32208	TS	3	11	3	11	is (IPCC 2007:64) (IPCC 2007, p. 64) ?	Editorial – copyedit to be completed prior to publication
19636	TS	3	2	3	3	This says “Working Group III of the IPCC is charged with assessing scientific research related to the mitigation of climate change.” This is born out by line 35 which speaks of “assessment of mitigation strategies.” Actually, the chapter uses the scientific knowledge base to assess potential policies for the mitigation of climate change. This real focus should be made clear to the readers.	Accepted - text revised.
21431	TS	3	28	3	30	Not clear how modelling assessments reflect real world "muddling through" policies	Noted - text revised.
30680	TS	3	31	3	33	This sentence reads as recommending a new or different process for linking science and policy. Suggest you consider revising to make the wording read less like a recommendation.	Accepted - text revised.
34260	TS	3	31	3	33	Given the many uncertainties involved in the assessment of mitigation strategies, there is a need for 31 an iterative, comprehensive and transparent process linking science with the design of policies that 32 are “robust” across a variety of scenarios. Insert 'and technogical practicality' after 'science' in this sentence.	Noted - text revised.
30679	TS	3	4	3	5	This sentence is unclear. Suggest avoiding use of the word 'likely' here in first half of the sentence because changes in some extreme events or impacts could also be assessed to be likely. Suggest rewording as follows: Because mitigation reduces the magnitude of climate change and associated impacts, it is part of.....(cont.).	Accepted - text revised.
31360	TS	3	46	3	48	Explanations of the treatment of certainty, evidence and confidence should be easy to find in the TS. Please consider to include a Box about this.	Accepted - text revised.
39023	TS	3	47	3	48	It would be useful to give reference to the defintiion of qualitative levels of "confidence," "evidence," and "agreement," since they are used throughout the TS and a reader may not be able to read the IPCC Guidance Note on Consistent Treatment of Uncertainties.	Accepted - text revised.
39096	TS	30				The caption to this figure does not seem to go with the figure. There is no thick black line or a blue dashed line in the figure. The caption mentions direct CO2 emissions by the y-axis says "fraction of 2010 level". Is this meant to be fraction of 2010 emissions? Also, what are the N= numbers in the figure?	Accepted. Figure has been re-worked to improve clarity and accessibility and caption has been adjusted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39097	TS	30				The authors should consider the best way to convey key message of this graph.	Accepted. Figure has been re-worked to improve clarity and accessibility and caption has been adjusted.
29130	TS	30				There is no black line to which the caption refers. The diagram is hard to interpret.	Accepted. Figure has been re-worked to improve clarity and accessibility and caption has been adjusted.
34741	TS	30	12	30	21	What is said here about the role energy efficiency / end use reduction seems quite modest, and somewhat in contradiction with expressions in the underlying chapters. It's not just "important" and "valuable", but "fundamental" to mitigation (see for example chapter 6, page 29, line 16). The chapter 1 says: "Numerous studies indicate that it will be unlikely to avoid dangerous anthropogenic interference with the climate system without drastic efficiency improvements (but also lifestyle changes)." (Ch1, p 34, lines 12-15).	Rejected , the paragraph just emphasizes that energy demand reductions alone are not enough for achieving deep cuts in emissions. However, the relatively important role of energy demand reductions in combination with a decarbonization of the energy sector has been emphasized in a better manner.
25029	TS	30	18	30	26	Readers of this text may infer that we should place lower priority on improving energy efficiency, and focus on low or zero carbon energy supply. This also tends to reinforce widely held but incorrect views that the scope for energy efficiency improvement is modest. A number of studies of energy suggest the global economy uses energy at an efficiency of a few per cent, so the scope for energy efficiency improvement is very large: capture of energy efficiency reduces the investment required in energy supply capacity and reduces consumer energy costs, as well as delivering a range of other benefits.	Accepted, new paragraphs on the important interactions between energy demand reductions and decarbonization of the electricity sector have been drafted.
28836	TS	30	2	30	2	Please use updated graphic from the SPM, this one has a wrong description ("The blue dashed lines refer to historical data as of 2009"), and the horizontal red dashed line should go across at "1" not at "0".	Accepted. Figure has been re-worked to improve clarity and accessibility and caption has been adjusted.
25570	TS	30	27	31	4	Non-CO2 gas reductions have been conducted under the Kyoto Protocol due to relatively cheap measures, and there are still large potentials for reducing non-CO2 gas emissions in the world. On the other hand, further deep emission reductions of non-CO2 gas must be very challenging and costly. The sentences here will focus on the later situation. It will be better to describe also the former point.	Noted. The importance of non-CO2 emissions in the industry sector have been emphasized.
32212	TS	30	4	30	4	impossible to understand what is the blue dashed line	Accepted. Figure has been re-worked to improve clarity and accessibility and caption has been adjusted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32600	TS	30	6		17	Without getting into details of this well-worn debate, surely it speaks to the point that this discussion should come before model results are presented? Again, modelingg results really shoudl eb trying to integrate the sectoral and technolgoical insights using a range of methodologies ... the TS does not read like that at all.	Rejected. The storyline of the TS is structured in a way that the IAMs provide insights about the requirements for reaching different mitigation targets. This cross-sector section then tries to combine the sectoral with the IAM perspective, by presenting new graphs that the projected shares of e.g. low carbon energy supplies in the energy demand sectors from TD vs BU studies are broadly comparable. Then the sectoral sections provide insights into the different sectoral mitigation options.
22902	TS	30	6	30	17	issue of hidden costs and negative cost policies need summary in ch15 and SPM and TS	Accepted. The issue of negative costs has been specifically covered in a box TS.12.
40914	TS	30	6	30	7	Please connect hidden cost with policy institution in Chapt. 15. Possibly it can be shown in SPM, and TS.	Accepted. The issue of negative costs has been specifically covered in a box TS.12. However, this box will not be shown in the SPM.
26298	TS	30	1	30	5	If I understand correctly, 1 is the same level of emissions of 2010; a fraction less than 1 implies a net reduction of emissions. A fraction less than zero, a net sink of CO2. In this context, I don't understand what can mean that the energy supply sector is deemed to be less than zero fraction in the 2100 scenario for both 450 and 550 stabilisation levels.	Accepted. The accompanying text will be re-worked to clearly state the role of electricity sector in achieving negative emissions, which would involve the combination of BECCS.
26299	TS	30	22	30	23	I suggest to specify a "small fraction". See comment on TS page 28, lines 12 to 13.	Accepted, paragraph has been redrafted.
28843	TS	31				These figures are much too small. What is shown? y-axis labels similar, but caption says "specific GHG emissions" and "comparative lifecycle emission values". Explain ALL abbreviations used. Left panel shows kg and right g, please harmonize. Left: what do the blue arrows and numbers mean, are they linked to "infrastructure + supplies"? What does "fuel chain" mean, fugitive emissions? The sentence in the "Note" is not understandable. Right: why is coal<gas? Explain abbreviations of the x-axis-label. The boxes all look the same except for fossils/CCS - not useful.	Accepted - figure layout and caption text revised.
40915	TS	31	1	31	4	Battery, fuel cell, hydrogen storage still have many problem including their energy density, handling and price, as written I nTS P35 L12-21. Therefore, please do not describe as if there are no major problems.	Accepted and sentence has been deleted.
28837	TS	31	13	31	16	Why are options presented in this sequence? In its current form the para starts with announcing the "main mitigation options", but then mentions many in a non-systematic manner. RE seems to be the most important option, and should be mentioned first. It is not appropriate to mention RE and nuclear at the end of the sentence and as if being of equal usefulness. Please rearrange paragraph.	Accepted - sequence now is revised.
25468	TS	31	17	31	18	change "existing coal-fired heat or power plants" to "existing inefficient coal-fired heat or power plants"	Accepted - text revised.
25604	TS	31	17	31	27	See comment No.6.	Noted - comment 6 cannot be identified.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25656	TS	31	17	31	19	This part should be revised to explain that it is important to use coal power efficiently from a viewpoint of energy security and economic efficiency. IGCC (Integrated Gasification Combined Cycle) technology is developing and has potential to reduce CO2 emission in the future, as described in (IEA, 2011, page7, page42 Fig14) and (Janos, 2009, page5, page7 Figure1 and Table 1). These literatures are listed in the No10 line of this table.	Rejected - the AR5 has to investigated option to mitigate climate change. IGCC are able to reduce emissions, but similar to gas-fired power plants, in the long-term this will not be sufficient to stabilize CO2 concentrations.
22428	TS	31	17	31	22	Although coal emits lots more CO2 than other fossil fuels, coal will play significant roll in energy sector because of its characteristics - cheap and widely distributed - that helps provide affordable electricity in developing and developed countries. Thus following sentense should be added after the sentence ending "power plants.": "Despite the adverse effects in climate change, coal plays an important role in achieving SD because it can provide affordable electricity worldwide."	Rejected - the AR5 has to investigated option to mitigate climate change. The cost associated with mitigation measures are addressed in chapter 6.
32455	TS	31	17	31	19	Energy security should also be considered. The utilization of highly efficient coal fired power plant should be mentioned.	Rejected - the AR5 has to investigated option to mitigate climate change. IGCC are able to reduce emissions, but the associated energy efficiency improvements are not sufficient to stabilize CO2 concentrations. Energy security is addressed in Table TS 2.
28838	TS	31	19			Explain "LCA evidence" please.	Accepted - text revised.
29131	TS	31	19	31	22	Clarity is needed over what is actually meant by "low GHG Natural Gas source" and "contemporary"	Accepted - text revised.
20836	TS	31	22	31	23	We can reduce large amounts of GHG emission by popularizing the best available technology of coal power. Effectiveness of it should be noticed.	Rejected - although the reduction might be large in absolute terms, in relative terms these are not sufficient to stabilize GHG concentrations.
31372	TS	31	24	31	24	Please consider to describe possible limitations related to negative side effects on health and enviornment.	Taken into account - comment is obsolete as underlying text has been deleted.
28839	TS	31	24			The "advent" of shale gas? It had always been there, what is new is the extraction by a technique that is know as "induced hydraulic fracturing" or fracking". Please reformulate using this expression.	Taken into account - comment is obsolete as underlying text has been deleted.
29132	TS	31	24	31	27	Can the change between AR4 and AR5 be quantified here.	Taken into account - comment is obsolete as underlying text has been deleted.
41074	TS	31	26	31	26	Should this make reference to the new IEA report 2013-TR1 on Shale Gas Greenhouse Gas Footprint?	Taken into account - comment is obsolete as underlying text has been deleted.
28840	TS	31	26	31	27	Please explain in a quantitative manner what is meant by this "downward adjustment" .	Taken into account - comment is obsolete as underlying text has been deleted.
34744	TS	31	28	31	29	Could clarify what this mean: Hence, replacing coal with NGCC can lead to stranded costs.	Taken into account - comment is obsolete as underlying text has been deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39099	TS	31	28	31	28	Are these "long-term stabilization targets" from Cancun? If yes, say so.	Taken into account - comment is obsolete as underlying text has been deleted.
28841	TS	31	28	31	31	The argument that in the long-run, NGCC still emit too much GHGs to meet stringent long-term stabilization goals should be included in the Summary for Policy makers (SPM 4.2.1, P.16, Line13-18)	Taken into account - comment is obsolete as underlying text has been deleted.
30716	TS	31	3	31	4	Suggest it is supportable to refer specifically to methane and nitrous oxide emissions here. Therefore suggest revising to read as follows: "Challenging emissions reductions of non-CO2 gases include those related to methane and nitrous oxide emissions from land use."	Rejected, paragraph has been removed.
26610	TS	31	31	31	40	Figure TS.19 is very confusing and misleading. Firstly, CCS is not a viable technology at this point in time. While there are demonstration projects, there is no evidence that this can or will be deployed at any scale relevant to emissions reductions. Furthermore, the graphs do not have significant explanatory text, e.g., the values for 2010 and 2050 are not sufficientely explained. Thirdly, the figure explanatory text notes that biogenic emissions for hydropower are not included, however the ranges provided indicate that they must be included. In addition, the full range of literature is not addressed. For example, Chanudet et al (2011) shows that hydropower reservoirs can be an emissions sink, which is not reflected in the figure.	Rejected in part- the figure compares potential mitigation options. It does not state that CCS is ready to be applied at scale. Accepted in part - diagram layout is revised and updated.
34742	TS	31	5	31	6	Halting deforestation as late as mid-century doesn't sound transformational, but business as usual. What explains such a late date, and how representative is this for the underlying scenarios?	Text has been updated according to the underlying text in section 6.8. 2. The relevant text from this section is copied here: In the majority of baseline scenarios from integrated models, net land use CO2 emissions largely disappear by mid-century, with some models projecting a net sink after 2050 (Section 6.3.1.4). There is a wide uncertainty in the role of afforestation and reforestation in mitigation, however. In some mitigation scenarios the land use sector can become a significant carbon sink (Section 6.3.2.4).
25467	TS	31	9			change the sentence "contribute to the limitation of" to "contribute limiting"	Taken into account - comment is obsolete as underlying text has been deleted.
39098	TS	31	9	31	10	This lead sentence needs to be revised as it is not clear at all. Suggest something like, "Limits on FF resources will not constrain emissions in the next few decades." or something like that.	Taken into account - comment is obsolete as underlying text has been deleted.
28842	TS	31				Given the high mitigation potential of RE this technical option and the recent developments (also shown in IPCC SRREN) should be highlighted more prominently in this chapter. Please start the chapter with RE technologies as mitigation option and then continue with fossil and nuclear technologies. Please cite SRREN here: RE play a major role.	Accepted - the text now starts with RE.
34788	TS	31		31		Technical Summary p.31. Right panel: Value provided GHG emissions for hydropower are strange … What is the source of this figure? My prosposition is to use the figure provided by SRREN report on that matter (ref. SPM 8 in the summary for policy makers). Why to add new figures?	Taken into account - the figure is updated as new LCA analysis have been carried out since the release of the SRREN.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26300	TS	31	32	31	40	In the left figure, coal based emissions are higher than NGCC, in the right figure, NGCC has higher emissions than coal.	Taken into account - figure has been updated. Note that CCS emissions are shown. Without CCS, IGCC have higher emissions than NGCC and this is shown.
25659	TS	32				The estimated cost for CCS in this figure should be revised to show the range of possible CCS cost because CCS cost depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), and (Lohwasser, 2012, Abstract). These literatures are listed in the No12 line of this table. In addition, the estimated cost for onshore wind in this figure should be revised to extend the range to the estimated cost of 180US$/MWh, that is assessed by verification committee for generation cost of Japanese government in December 2011.	Taken into account - figure and numbers were updated. Note that the given value for wind onshore is in the uncertainty range.
22909	TS	32		32		DELETE PV as it is misleading to plot module costs - now the majority of costs of PV is "balance of systems" forwhich learning rate is much lower.	Taken into account - figure has been deleted.
21480	TS	32				The left panel is strange since it suggests that the uncertainty for CCS (an unproven technology) is smaller than for the other technologies that are well established, such as wind turbines. This needs correcting since this appears to be based on a small (biased?) sample. It is also unrealistic since storage costs are hardly known and will also depend on the quantities to be stored.	Taken into account - figure and numbers were updated.
34746	TS	32				The source for the LCOE of nuclear is IEA report from 2010. That's pre-Fukushima. After Fukushima extra risk control measures have increased costs of nuclear. In this light, the data use here and in the underlying chapter 7 is outdated and the low estimations of the range seem too low. The U.S. Energy Information Administration estimates in its Annual Energy Outlook 2012 the LCOE for advanced nuclear in the US to be 111 $ / MWh. That's a national assessment, and the discount rates might not be comparable, but it's indicative.	Noted - the given value of 111$/MWh is in the range. The lower value is for Korean reactors, not for US ones.
30717	TS	32	1	32	18	Lines 2-4 present an important conclusion regarding the likelihood of achieving negative emissions through BECCS. This conclusion is particularly important given the repeated references throughout the TS (and other chapters of the WGIII report) to the importance of BECCS to achievement of negative emissions and ambitious mitigation targets. Therefore, it is surprising that there is no additional information about BECCS in the paragraphs that follow in support of the bolded text. Suggest adding some information that communicated the status of BECCS as a mitigation technology.	Accepted - text revised.
34745	TS	32	1	32	15	This paragraph should be more representative of what is said in the underlying chapter, about developments on CCS since AR4: "The implementation of large-scale CCS systems generally requires extensive funding and an array of complementary institutional arrangements such as legal frameworks for assigning liability for long-term storage of CO2. Since AR4, studies have underscored a growing number of practical challenges to commercial investment in CCS. (Ch1, p 10, lines 42-46.)	Accepted - text revised.
34747	TS	32	1	32	8	Since the aim is to take stock too, on what has happened since AR4, the TS could reflect what is said about this in the Chapter 2: "In the period between the publication of AR4 and the accident at the Fukushima power plant in Japan in March 2011, the riskiness of nuclear power as a climate mitigation option has received increasing attention." (Ch2, p 57, lines 7-9)	Rejected - the TS here refers to the outcome of chapter 7. Space constraints do not allow to go into such details. The decline of the share of nuclear power in the power mix, however, is mentioned.
25658	TS	32	16	32	17	This part should be kept in the final version report and also explain that CCS projects should be implemented preferentially from the verified sites where safety and economic feasibility are confirmed. Insufficient verification causes a large amount of social and economic damages.	Noted - due to space constraints resource assessments were deleted for all mitigation options.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39100	TS	32	16	32	18	The statement about global CO2 storage capacity is only partially correct. It is also partially false. The capacity estimates we have are really quite speculative. The corollary would be oil company estimates of "potential reserves". In truth, much of this potential CO2 storage capacity may prove to be economically infeasible to use. Thus, while there is a large "potential reservoir" for CO2, the actual proven reservoir is vanishingly small. The statement is misleading, and should be amended to acknowledge the immense unsolved practical challenges associated with putting CO2 underground and keeping it there.	Noted - due to space constraints resource assessments were deleted for all mitigation options. The comment therefore is obsolete.
25158	TS	32	19	32	32	Advise complete rewrite. See Comment on Chapter 7 entitled: **PV cost data inadequate to support claims and inappropriate for policymaking (includes internal conflict and affects Technical Summary p32 and Summary for Policymakers pg 17)	Taken into account - the cost paragraph have been completely revised.
29133	TS	32	2	32	3	"BECCS might allow negative emissions" is not substantiated.	Taken into account - a couple of paragraphs were added to the chapter 7 text to support the argument of negative emissions. In addition, the wording in the TS and the SPM has been revised.
28845	TS	32	27	32	28	These figures are too small to read. Please enlarge them. See our comments on this figure in the SPM.	Accepted - layout is changed.
25030	TS	32	28	32	32	Suggest the caption or text should point out that the distributed energy options compete against retail electricity prices, which are much higher than wholesale, as they do not require transmission and distribution, which comprises a large proportion of grid based electricity cost.	Rejected - cost discussion has been revised. Space constraints do not allow to go into these details.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26385	TS	32	28	32	30	I suggest to include fuel cells technology in Figure TS.20. Left Panel. In particular I suggest to include: the Fuel Cells ENE-Farm LCOE data as provided by the Japan National Policy Unit (NPU) Energy and Environment Council's Cost Review Committee in "Cost Review Committee Report"; the Fuel Cells plant LCOE data (referred to the US context) as provided by OECD-IEA-NEA in "Projected Costs of Generating Electricity" (2010 Edition); the H2FC Powertrain LCOE 2017 data target as indicated in M.V. Romeri analyses. So, it is necessary to integrate consequently the text: "Figure TS.20. Left panel: Levelised cost in $/MWh of electricity for commercially available energy technologies as observed for the fourth quarter of 2012 (and for the second quarter of 2009). For nuclear, fuel cells, and CCS projected costs are shown [Figure 7.10]". REFERENCES. ENE-Farm LCOE, see: Japan National Policy Unit (NPU) Energy and Environment Council's Cost Review Committee, "Cost Review Committee Report" (コスト等検証委員会報告書 平成23年12月19日), Tokyo 2011 (p. 62), <http://web.archive.org/web/20130221042347/http://npu.go.jp/policy/ policy09/pdf/20111221/hokoku.pdf > or, "Electricity Generation Cost by Source" (主な電源の発電コスト) <http://web.archive.org/web/20130221042625/http://npu.go.jp/policy/policy09/pdf/20111221/hokoku_kosutohikaku .pdf >. Fuel Cells plant LCOE, see: OECD-IEA-NEA "Projected Costs of Generating Electricity", 2010 Edition, <http://www.oecdbookshop.org/oecd/display.asp?lang=EN&sf1=identifiers&st1=978-92-64-08430-8 > or <http://www.debateco.fr/sites/default/files/2010%20IEA%2BOECD%20on%20Costs%20 Electricity%20.pdf>. H2FC Powertrain LCOE, see M.V. Romeri analyses: "Considering Hydrogen Fuel Cells Powertrain as Power Generation Plant" presented at EVS25, 2010, Shenzhen, Guangdong, China, published in World Electric Vehicle Journal Volume 4 (2011), <http://www.evs24.org/wevajournal/php/download.php?f=vol4/WEVA4-4131.pdf >; "Hydrogen Fuel Cell Powertrain Levelized Cost of Electricity" presented at the 30th USAEE/IAEE North American Conference, 2011, Washington DC USA, published by USAEE & IAEE Research Paper Series, <http://ssrn.com/abstract=2006758>; "The Hydrogen Fuel Cell Vehicles Powertrain Roles in the Copenhagen Accord and Cancun Agreement Perspective" presented at 2011 Fuel Cell Seminar & Exposition, Orlando FL USA, and published by ECS The Electrochemical Society, ECS Transaction, Volume 42 < http://ecst.ecsdl.org/content/42/1/59.abstract >; "Consideration about the Hydrogen Fuel Cell Powertrain LCOE" presented at the 3rd IAEE Asian Conference, Kyoto, Japan, 2012, <http://eneken.ieej.or.jp/3rd_IAEE_Asia/pdf/paper/025p.pdf >; "Consideration about Hydrogen Fuel Cell Powertrain Levelized Cost of Electricity" presented at CARS 21 Public Hearing 2012, European Commission, DG Enterprise and Industry, Automotive Industry Unit. Brussels Belgium, <http://circa.europa.eu/Public/irc/enterprise/automotive/library?l=/cars_working_groups/cars_hearing_2012/romeri _cars21_defpdf/_EN_1.0_&a=d >.	Rejected - space constraints do not allow for a consideration of very specific technologies.
39101	TS	32	33	32	34	Suggest rephrasing this as a positive statement (negative statements deter the reader) for a stronger impact, i.e., "The global technical potential.. is sufficient to mitigate climate change…." Change "does not pose a practical constraint on their contribution" to "is sufficient".	Taken into account - comment is obsolete as underlying text has been deleted.
40916	TS	32	33	32	36	The sentence sounds like there are no drawbacks in solar cells. However, there are still many problems, including maintenance, cost, generation stability in introducing renewable energies. It is necessary to clear all the problems for "real " solution of PV. So, please list up the targets for "real" usage of photovolcanic cells. Unless otherwise, this part should be deleted.	Taken into account - comment is obsolete as underlying text has been deleted.
29134	TS	32	33	36		If there is only medium confidence and medium agreement around this statement some consideration of the debate and issues around this would be beneficial here.	Taken into account - comment is obsolete as underlying text has been deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25159	TS	32	33	32	36	Advise deletion. See comment on 7.4.2 entitled: **Section 7.4.2, total global potential of renewable energy, open to critique for highlighting trivial data and overlooking relevant challenges. (affects the Summary for Policymakers, page 17, lines 5-13 and the Technical Summary, page 32, lines 33-36)	Taken into account - comment is obsolete as underlying text has been deleted.
39102	TS	32	35	32	35	Add to the text here, "and the ability to meet these technical potential will be challenging."	Taken into account - comment is obsolete as underlying text has been deleted.
28844	TS	32	4	32	5	It should be noted that all the components exist, but most of them do not work on the scale that would be necessary. There is a difference between storing a few million t per year and several hundred mio. t.	Accepted - text revised in order to emphasize that no CCS power plant "at scale" is available.
24419	TS	32	4	32	5	Although CCS technologies exist, but have not been in use in various parts of the fossil energy chain yet. Therefore the last half sentence sounds incorrect.	Rejected - the text speaks about the component - not about a full scale integrated systems.
31373	TS	32	7	32	8	Although CCS has not been applied to a large commercial fossil-fired electricity generation facility, CCS has been commercialy deployed to other related sectors such as gas processing (Global CCS Institute, table 1 in http://www.globalccsinstitute.com/publications/global-status-ccs-2012/online/47981).	Noted - this is what the sentence says.
25657	TS	32	7	32	8	This part should be kept in the final version report and also explain that there are many concerns about CCS such as safety confirmation, storage potential, high cost or public acceptance, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), (Lohwasser, 2012, Abstract), and (Zoback, 2012, Abstract). CCS cost depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring. These literatures are listed in the No12 line of this table.	Taken into account - the risks and costs are now mentioned explicitly. The other suggestions however are to specific to be included.
29731	TS	32 of 59	1		8	We suggest the following edits to this paragraph on CCS technologies: "CCS technologies COULD THEORETICALLY significantly reduce the specific carbon dioxide emissions of fossil-fired power plants. BECCS might allow negative emissions by effectively removing CO2 from the atmosphere (medium evidence, medium agreement), THOUGH THE CURRENT STATE OF BOTH BIOENERGY AND CCS MAKES THIS STATEMENT SPECULATIVE." Further, if the "critical advances in the knowledge of CCS systems and their engineering, technical, economic and policy impacts" are not going to be enumerated or assessed here, leave this sentence out of the TS; it is not informative.	Taken into account - the challenges and risks of CCS and BECCS now are discussed in additional paragraphs. The sentence is deleted as suggested.
40920	TS	33				DELETE PV as it is misleading to plot module costs - now the majority of costs of PV is "balance of systems" for which learning rate is much lower.	Taken into account - figure TS 20, right panel is deleted.
28846	TS	33	1	33	2	The aspect of significant risk must be reflected in the first sentence: "Nuclear power is not a practible mitigation option given the significant risks of large scale accidents and subsequent economic, social and environmental disasters." Alternatively the words "is a mitigation option" must be deleted.	Rejected - the suggested wording would be prescriptive. The risks associated with nuclear, however, are clearly stated.
28847	TS	33	1	33	2	The life-cycle basis of nuclear energy is still not given. Unsolved problems and risks still exist (see line 3-8). Thus line 1-2 are contradictory to line 3-8 and should be reformulated in a more balanced way.	Rejected - line 1-2 refer to emissions, while the other lines refer to risks and resources. The text, however, has been reformulated in a balanced way.
29135	TS	33	1	33	1	It is highly unlikely that generated electricity will ever be truely carbon free, albeit ultra-low carbon.	Accepted - text revised.
39107	TS	33	16	35	21	This transportation section talks about electric vehicles (EV) but makes very little mention of the importance of the electricity generation used to charge the EV. This section would benefit from some discussion of how life cycle emissions for EVs depend to some extent on the electricity generation mix.	Accepted, a note needs to be inserted to reflect this.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29136	TS	33	17			Fuels don't require high energy density. Transport requires high energy density fuels. But sentence would make sense if remove word 'many'.	Wording has been changed to address comment.
28852	TS	33	18	33	20	This sentence is not logical: The share is not growing, because rising emissions from energing economies and aviation are predicted. Better write: The share will (most likely) grow ...	Wording has been changed to address comment.
40918	TS	33	19	33	27	Currently, renewable energy like solar cells are not economically affordable without subsidies. The cost of the panel is part of its total cost, and the system cost for stable electricity supplement is much larger problem than panel cost. Those facts should be clearly indicated here.	This comment refers to page 32, line 19: Accepted, finding will be reworded to refer specifically to LCOEs and system costs.
26036	TS	33	2	33	5	"Although nuclear power has been used for five decades, unresolved issues remain for a futureworldwide expansion of nuclear energy. The related barriers include operational safety, proliferation risks, waste management and the economics of power plants". RECOMMEND: "Public acceptance of nuclear power is affected by perceived concerns relating to safety, waste management and proliferation. " JUSTIFICATION: The expression "Unresolved issues remain for a future worldwide expansion of..." could be written for other generation technologies, but has not been. For example, in the following section on renewables there is no reference to the unresolved issues of intermittency. Nuclear energy, supplying 13% of global electricity and in existance for over 50 years is a more proven technology than many other low carbon options.	Accepted - text revised.
28853	TS	33	20	33	22	The mentioned difficulties exist mostly regarding long distance transport. For urban transport (LDV, pedelecs, hybrid/electric cars, ..) electric solutions are state of the art alternatives and most likely to play an important role in the future. Regarding this topic, please distinguish between long and short distance transport/travel.	Accepted - this needs to be included in the new TS version.
32213	TS	33	22	33	22	"with the exception of electric rail and wood gas vehicules" cf corrections to chapter 8	Noted.
28854	TS	33	23			"improving energy intensity": This term is scientifally correct, but misleading. Wouldn't "reducing energy intensity" be a much more comprehensible term?	Wording has been changed to address comment.
28855	TS	33	23			"reducing fuel carbon intensity": carbon itself is not climate affective as long as it is taken from the atmosphere or industrial processes and not from fossil carbon. Correctly, the term should be "reducing fossil fuel carbon intensity"	Rejected, this term is used throughout the entire report to describe the reduction in the net carbon intensity of fuels; as such, the carbon intensticy of biofuels also depends its lifecycle emissions, in particular related to the production of the biomass feedstock.
28856	TS	33	24			"reducing activity": better use the precise term "avoid" or "demand magement"	Wording has been changed to address comment.
28848	TS	33	3	33	4	Please change "issues" to "risks". A nuclear accident, for example, is defined down by calling it an "issue".	Accepted - the word issue is deleted.
40919	TS	33	30	33	30	Please make clear that "until 2050."	Sentence has been reworded so that this correction is not applicable anymore.
32857	TS	33	32	33	35	Agree with "Technological “improve” and behavioural “shift” and “avoid” options may contribute more to mitigation than was assumed in AR4." Disagree with "Activity reduction in future decades (due to internet shopping, video conferencing, social networking etc.) against baseline could impact on climate change mitigation." Suggest remove "(due to internet shopping, video conferencing, social networking etc.)." Internet shopping, for instance, see Rattle (2010) pp 66 - 71 and 107 - 108; social networking, for instance, see special issues http://www.triple-c.at/index.php/tripleC/issue/view/25 as well as http://www.i-r-i-e.net/current_issue.htm and specifically http://www.i-r-i-e.net/inhalt/018/Rattle.pdf	Sentence has been removed.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39108	TS	33	32	37	31	An estimate of the impact that individual behavior change could make on transport or buildings appears to be missing. Some of the following references may be helpful, with this text provided for some context. Demand-side energy reductions can significantly contribute to addressing climate change and energy security problems. In the United States, a sizable portion of energy use comes from the residential sector – estimated to be about 22% from residential buildings and 16% from passenger cars and light trucks (Energy Information Administration 2008). Greenhouse gas (GHG) emissions follow a similar pattern (EPA 2006; Vandenbergh et al. 2008). In addition, the United States Department of Agriculture (USDA) estimates that food-related energy use accounted for about 16% of the U.S. energy budget in 2007 (Canning et al. 2010). Estimates indicate that reductions in home, transportation, and food-related energy use are achievable at little or even negative cost, making such reductions particularly attractive, at least in the short-term. Importantly, many experts agree that a major reason why reductions have not yet been achieved in these sectors involves obstacles that the social sciences are particularly well-suited to address (IPCC 2007; American Physical Society 2008; UNEP 2010; McKinsey & Company 2009). More specifically, it is estimated that energy behavior change can reduce residential energy consumption by about 30 percent (Parker et al. 2006; Gardner and Stern 2008; Laitner, Ehrhardt-Martinez, and McKinney 2009; McKinsey & Company 2009). This is about 15% of total U.S. energy consumption – more than the total yearly energy consumption in Brazil or the UK, or the quantity of fossil fuels that would be saved and GHG emissions reduced in the U.S. by a 25-fold increase in wind plus solar power, or a doubling of nuclear power (Energy Information Administration 2008; Sweeney 2007). This information suggests that interventions aimed at promoting energy saving actions by individuals in the residential sector can contribute significantly to addressing the problems of climate change and energy security. [Full citations provided upon request.] Also see the following (and corresponding white paper) for an outstanding assessment of energy efficiency technologies (current and under development) and their potential energy saving capacities: Philip Farese 1 6 AU G U S T 2 0 1 2 , VO L 4 8 8 , N AT U R E, 2 7 5-277,	Noted. A number that combines the estimates for behavioural change in combination with structural changes has been integrated in the SPM - the relevant adjustments for the TS still need to be made.
28857	TS	33	32	33	33	Well done, it is very important to illustrate the concept "ASI" (avoid, shift, improve) because politicians tend to focus on technical measures (improve) as they are most "easy and quick" to achieve.	Noted. Sentence has been slightly modified for new version but meaning has been maintained.
25420	TS	33	33	33	35	“Activity reduction in future decades (due to internet shopping, video conferencing, social networking etc.) against baseline could impact on climate change mitigation.” COMMENT: This sentence should be deleted. REASON: Chapter 8 don't describe about noted above (even, internet shopping, video conferencing, or social networking). Since there are no evidence and reference, this statement is not appropriate for TS.	Accepted, sentence has been deleted.
20837	TS	33	4	33	5	Seeing "Figure SPM.12.", it is confirmed that the nuclear cost is not higher than other sources. We should delete "the economics of power plants" from the barriers of nuclear energy.	Accepted - text revised.
25605	TS	33	4	33	5	See comment No.7.	Noted - comment no 7 could not be located.
39103	TS	33	4	33	4	Say weapons proliferation, not simply proliferation. Make the connection between nuclear power and nuclear weapons explicit, which it is.	Accepted - text revised.
28849	TS	33	4	33	5	The mining for Uranium is accompanied by significant social and environmental costs. Shouldn't this be discussed as an important associated effect?	Accepted - mining issues are discussed in Table TS 2.
39109	TS	33	40	34	7	The authors should consider adding a sentence to highlight key message for this paragraph, while also condensing its overall length.	Accepted, paragraph was shortened and focused.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22426	TS	33	5	33	5	Delete "the economics of power plants" and insert "the public acceptances" instead of that wording. Difficulties in gaining public acceptances is one of the biggest barrier in building new nuclear power plants rather than economic issue. If the economics of power plant is really an issue, why there exists many new nuclear building plans in emerging countries?	Accepted - text revised.
39104	TS	33	5	33	8	What is meant by the statement, "Constraints to resource availability (for nuclear) are limited if recycling processes are taken into account"? Do you mean that resources are less constrained (e.g. more available)? Or, do you mean that options become more limited? Recycling does greatly reduce the constraint on the availability of nuclear fuel.	Taken into account - comment is obsolete as underlying text has been deleted.
25660	TS	33	9	33	15	This part should explain that the need for system balancing caused by variable RE resources, as described in the section 7.6.1 (page 32, line 3). The higher planning reserve margin will result in more costly structure as a whole power system. This is because it is necessary to install additional equipments for power grid stabilization if variable power sources such as wind power or photovoltaic were installed into power grid, as described in (DeCarolis, 2006, page 395 and 403). This literature is listed in the No15 line of this table.	Accepted - integration issues now are mentioned, but space constraints do not allow for going into the details in the TS.
22903	TS	33	9	33	15	KEEP this para as it is important to acknoledge the current statu of RE.	Noted
34748	TS	33	9	33	10	This bolded sentence could also be phrased in a more positive way: While some RE technologies are already competitive with market energy prices, others will still need to be subsidised directly or indirectly. This para would also benefit from mentioning removal of fossil fuel subsidies, as a policy that would create level playing field.	Taken into account - part of the text is revised. Space constraints do not allow for an inclusion of the subsidy issue.
25436	TS	33	9	33	15	A little surprised that there is no mention of fossil fuel subsidies and their relationship to RE market prices. Removing fossil fuel subsidies would also improve RE market viability.	Noted - unfortunately space constraints do not allow to go into the details here.
25053	TS	33	9	33	15	Keep this paragraph.	Noted
39105	TS	33	9	33	15	"Many RE technologies will only be competitive with market energy prices and grow in their contribution if they are directly or indirect subsidized, if there is an intention to further increase their market share." Photovoltaics without subsidies is at or below grid parity today in many locations around the world. When the levelized cost of energy is below grid parity it is competitive with market energy prices. In this case the growth of PV is not limited by subsidies but the availability of capital.	Accepted - text revised.
39106	TS	33	9	33	15	It is inaccurate to say that RE will only be cost competitive with market energy prices if they get a direct or indirect subsidy. This is only true for our inaccurate energy markets, where the market price of energy is << the true cost of that energy (e.g., when environmental and security externalities are considered). If the price of energy in our energy markets reflected its true cost, then RE could well be less expensive than fossil. One could argue that internalizing externalities into the market price amounts to an indirect subsidy. But, it could also be done via other methods (e.g. taxes to fossil). The authors need to revise the text to incorporate this perspective.	Accepted - text revised.
40917	TS	33	9	33	15	To acknowledge the current status of renewable energy is very important. Please do not delete this paragraph.	Noted
28850	TS	33	9	33	10	Some RE are already today competitive (e.g. Wind). There are a lot of factors influencing the economic competitiveness of an energy source (such as subsidiaries, taxes etc.) Please replace "Many RE technologies will only…" by "Many RE technologies are not competitive with market prices yet"	Taken into account - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28851	TS	33	9	33	15	This para presents REs in an extremely negative way, which is surprising given the very optimistic findings of the SRREN. It seems that the intention of the para was to address subsidies and barriers, but this is not really clear. At the moment is mentions problems with REs together with all kinds of other - but more serious - problems related to other technologies. Please revise this para in a more neutral way wrt to RE and clarify content.	Accepted - text revised.
25160	TS	33	9	33	11	Advise rewrite. In order to increase contribution, the authors must show there is 1) and offset of fossil fuels through RE development and 2) that subsidies and buildout of RE do not lead to greater energy use than deploying fossil fuels through conventional means. The high cost of RE reflects a variety of intermediary costs such as labor, materials, fabrication, transportation, installation, and maintenance. Solar and wind power systems also incur costs for power conditioning, battery backup, or concurrent conventional infrastructure to fill gaps in service due to intermittency. These intermediary costs in turn indicate primary energy costs, which are largely supplied through conventional fuels. Until unsubsidized RE costs fall below the costs of fossil fuels they rely upon, RE may in effect represent fossil fuel consumption by alternate means (Zehner, 2012). Zehner, O. (2012). Green illusions. University of Nebraska Press, Lincoln and London.	Rejected - the text speaks about market shares not about mitigation. In order to avoid any confusion, the text has been revised.
29137	TS	33				In the HDV and ship sector other ideas may well reduce energy consumption more than improving logistics and engines. These include dynamic tyre pressure adjustment for HDVs and bubble curtains on ship hulls plus wind assist (use of on-board rotors as sails). For this sector, the use of electric vehicles or hydrogen would not be an option due to insufficient range, however the use of Liquefied Natural Gas (LNG) is being actively pursued as a way of generating less CO2 per km travelled and is not mentioned.	Accepted, relevant sentence may need to be re-included.
32274	TS	33	1	33	18	same as #27 It is necessary to discuss the availability (and its uncertainty) of BECCS as huge amount of CDR appears to rely on BECCS in the scenarios produced to meet the 450ppm target.	Taken into account - the challenges and risks of CCS and BECCS now are discussed in additional paragraphs. The sentence is deleted as suggested.
26302	TS	33	22	33	24	I suggest to add in the sentence: "Mitigation options in the transport sector (…), and reducing activity (the need for journeys) and to eliminate subsidies for fossil fuel consumption."	Rejected, the issue of removing fossil fuel subsidies is addressed in the policy section TS.4.2.
26301	TS	33	9	33	11	I do not agree with the statement that "many RE technologies will be competitive with market energy prices (…) if they are directly or indirectly subsidized (…)". It is difficult to assess the future price of any energy source and, as the figure TS.20 shows, there is a technology learning curve for all RE (and other) technologies. I suggest to put: "At current levels, some RE technologies will be competitive (...)"	Taken into account - text revised.
34547	TS	33	25	33	27	Regarding the text of "In Integrated Assessment Model (IAM) scenarios, total passenger transport demand (passenger km / year) more than doubles, or even triples between 2010 until 2050 with freight demand (tonne km / year) growing by around 80% over the same period (medium confidence)...[8.1]" in TS.4.3 "Transport", as there is no evidence in Chapter 8 (either from 8.1 or 8.9) to support such a conclusion because it is not mentioned about the transport demand until 2050, please provide the evidence or explaination, otherwise this consuclusion needs to be amended or deleted, and consequently the text of "top-down models, total passenger transport demand, (passenger km/yr), almost triples between 2010 until 2050 and freight movements (tonne km/yr) double [8.1, 8.9]." in SPM.4.2.2 Energy end-use sectors should be updated, too.	Taken into account - sentence has been removed from TS.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34548	TS	33	30	33	31	"While OECD countries stabilize their transport demand, emerging economies nearly triple theirs. [8.1]" should be deleted since there is no such a conclusion in section 8.1 of Chapter 8, in fact it is stated in Chapter 8 that “Rapid increase of transport demand is caused by the strong growth of freight and air travelled kilometers worldwide, in non-OECD countries it is in part motivated by a fast demand growth that are starting at a very low base [FAQ 8.1]"	Sentence has been reworded to more adequately reflect the regional differences and to closely correspond to the underlying chapter material.
29138	TS	34				It would be useful to breakdown passenger rail into electric and diesel as with freight. Also for road transport it would be beneficial to separate out petrol, diesel, hybrid and even electric cars. In the key it is not clear what 'thermal electricity for rail' refers to?	Rejected, this provides too much detail for TS.
28858	TS	34	13			Please move Note in inset of the figure to the caption.	Rejected, figure has been completely redesigned.
40921	TS	34	18	34	20	Very reasonable description of current situation. Please maintain it.	Accepted, but text has been rewritten and the focus of arguments shifted.
28859	TS	34	21	34	23	It is correct, that electric vehicles do improve the realization of fuel economy standards, but be aware that their actual contribution to climate protection is closely related to the energy generation prior to consumption. If the the used electrical energy stems e.g. from coal power plants, conventional propulsion systems are better regarding GHG-emissions.	Accepted, relevant sentence needs to be included
25421	TS	34	23	34	25	“In total, reducing vehicle fuel consumption of newly sold vehicles by 50% globally in 2030 in an ambitious but feasible target, translating into about 50% reduction of fuel use by LDVs in 2050.” COMMENT: "but feasible target, translating into about 50%reduction of fuel use by LDVs in 2050." should be deleted. If this sentence will remain, the refrence (e.g. "[8.3]") should be indicated. In the case that it would be described based on MIT paper, "by 50%" sould be replace with " by 50% maximum" and "in 2030" should be replace with "in around 2035". REASON: In chapter 8, this statement is referring GFEI, but GFEI does not discuss feasibility from technology perspectives. Only MIT paper (in SOD references) discusses feasibility. Therefore, if IPCC intends to keep the word "feasible", IPCC should indicate the reference to MIT after this statement. Even in that case, MIT conclude (as of 2008) that a 30-50% reduction in fuel consumption is feasible over the next 30 years.	Accepted, sentence in TS has been deleted.
40922	TS	34	23	34	25	Please describe the base year.	Rejected, relevant sentence has been removed.
28860	TS	34	28			"non-fuel" instead of "fuel"?	Rejected, relevant sentence has been removed.
28861	TS	35	10	35	11	All increases in efficiency in this paragraph listed by transport mode and percentage seem to be derived from scientific studies. In this last sentence the corresponding figure for rail is based on a political target by the EU. This seems very inconsistent to me. It is illogical to communicate to politicians their own targets instead of scientific proven facts. Please modify.	Accepted, sentence has been removed.
34749	TS	35	12	35	15	This para should bring in some findings from CH11, pages 80-81, about the true life-cycle emissions of biofuels, including emissions from indirect land-use change (ILUC). Assuming biofuels as carbon neutral can be dangerously misleading. It is not enough to discuss the sustainability of biomass only in the AFOLU section. As it reads in Chapter 11, page 11, lines 36-38: " Biospheric C losses associated with LUC from some bioenergy schemes can be, in some cases, more than hundred times larger than the annual GHG savings from the assumed fossil fuel replacement (Gibbs et al. 2008; Chum et al. 2011)."	Rejected, the issue of ILUC is addressed comprehensively in the section TS.3.2.4 under AFOLU; also the current sentence refers to 'sustainable feedstocks' which provides a clear indication of the problem in question.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40923	TS	35	12	35	21	Now many researches are going on for the resolution to the problems. Such efforts should be described. Please refer, for example, "Low CO2 electricity and Hydrogen: A Help or Hinderance for Electric and Hydrogen Vehicles?" , T. J. Wallington, M. Grahn, J. E. Anderson, S. A. Mueller, M. I. Williander and K. Lindgren, Environmental Science and Technology, 44, pp2702-2708 (2010)	Rejected. In the TS no single studies can be addressed but the findings from the underlying chapter are summarized.
28862	TS	35	12	35	15	It would be extremely difficult to reduce the CO2 intensity for biofuels close to zero. Even if iluc effects are excluded there would be a bottom of CO2 emissions due to harvesting and production.	Accepted and sentence has been reworded.
28863	TS	35	12	35	21	There are different ways mentioned to replace oil products in the transport sector. The possibility to generate gaseous and fluid fuels with regenerative electricity (power-to-gas and power-to-liguid) is not considered. These "synthetic fuels" may play a major role in mid / long term and should be addressed in the report. (If they are not considered, this should be clearly mentioned.) This would also put "decarbonization" into other perspective, as synthetic fuels still contain carbon. Thus, the aim is avoiding fossil carbon".	NOTED this still needs to be addressed.
39110	TS	35	22	37	31	For the TS on building section, general comments are to ensure consitency with actual contents presented in Chapter 9, and to add statements on the need for promoting building science education worldwide. In addition, many statements (in bold) contain "x"-fold to "y"-fold, a factor of x or y , etc., when comparing or quantifying energy savings magnitudes, please ensure these are supported by reliable and representative studies.	Noted. The new draft has been written considering these suggestions.
39111	TS	35	22	37	31	Why no discussion of using renewable building materials (e.g. wood, etc.)? These reduce energy requirements, and sequester carbon... see AFOLU chapter.	Noted. Good point, but space did not allow a detailed discussion of this. The underlying chapter does discuss lifecycle assessment of construction materials.
30718	TS	35	29	35	38	Is this a mistake to refer to the AR4 results? Should this be AR5? If these are AR4 results, then why include them here in the TS of the AR5?	Noted. AR4 is referred to as a reference, but the revised TS is now clearer on this point.
25446	TS	35	4	35	7	KEEP these sentences as it is important to indicate "eco-driving" and "Intelligent transport system". (An additional 5-10% fuel savings can 4 possibly be achieved by fuel economy measures such as ship speeds, eco-driving, improved aviation 5 and airport logistics. Better traffic management, intelligent transport systems, better vehicle and 6 road maintenance may achieve another 5-10% in fuel savings.)	Rejected, relevant section has been rewritten.
32214	TS	35	4	35	6	Ecodriving can spare 10-30% cf correction to chapter 8	Rejected, relevant sentence has been removed.
33620	TS	35	40	35	41	energy plus buildings and solar heating and cooling could be mentioned, too.	Noted. The chapter did not have space to cover every technology; these are implicitly included in very high performance buildings. No well-documented cases of energy plus buildings have been found for possible inclusion in the various analyses in the chapter.
25661	TS	35	40	35	43	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from building sector, as described in (IEA/OECD, 2010, page6-64) and (IEA, 2011, page16). These literatures are listed in the No17 line of this table.	Noted. Unfortunately there was no space to discuss individual technologies, heat pumps are covered substantially implicitly under very high performance buildings.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23163	TS	35	9	35	11	There is no evidence such enormous efficiency improvements are achievable for these mature technologies.	Sentence has been removed.
32215	TS	35	9	35	10	Flight rescheduling can reduce contrail and contrail-induced cirrus by half of the total radiative effect. Cf my addition to chapter 8	Noted.
29755	TS	35	19	35	21	fullstop missing, two sentences look like one. Pls add fullstop after 'vehicles'.	Editorial – copyedit to be completed prior to publication
25031	TS	36	1	36	2	The reference to avoiding cooling reflects a European perspective. In many parts of Asia and other hot regions, active cooling and dehumidification is more likely to be needed. However, this need coincides with the availability of a lot of renewable energy. Suggest rebalancing to reflect a more global perspective.	Noted. The point on the cooling avoidance was actually written by an Asian author of the team, with good documentation of the evidence. Nevertheless the revised TS tries to balance other perspectives, too.
33622	TS	36	10	36	13	Should the quality of the building design and building envelop (as the 1st step of the Trias Energetica, see a comment above, and also the first step of the passive house design) be mentioned as first? Advanced building control systems and high-efficiency appliances/equipment are important to manage the remaining energy demand...	Accepted, and hopefully the new TS addresses the concern of the reviewer.
40924	TS	36	10	36	13	To recognize that building mitigation policy depends upon the culture and area is very important (Chapt 9, P55 L17-21). Therefore, please describe about it.	Accepted. The new TS covers this area with more detail.
31169	TS	36	16	36	17	phrasing is awkward	Accepted. Rewritten.
21481	TS	36	31			In many parts of the world where mechanical cooling systems	Comment unclear
39112	TS	36	31	36	40	The statement "In many parts of the world where mechanical systems are not affordable, principles of low-energy vernacular designs have evolved over centuries and provide sufficient comfort conditions." is generally not true. There are many vernacular traditions, if not the majority, that do not provide comfortable, much less healthy, environments and/or low energy consumption. "Barrios" and their many variants across the globe provide one conspicuous class of buildings that fail to provide comfortable, healthy and energy conserving environments, but there are many others. Perhaps a more appropriate statement would be: "In many parts of the world where mechanical systems are not affordable, some low-energy vernacular designs principles have been developed that, informed by modern methods and techniques, may provide sufficiently comfortable and healthy environments."	Noted. This part has been significantly shortened and rewritten.
30719	TS	36	39	36	39	What is SHW? No reference to SHW was found in a scan of Ch. 9 either.	Accepted, this abbreviation is not used in the new TS.
39113	TS	36	39	36	39	What is "SHW"?	Accepted, this abbreviation is not used in the new TS.
29139	TS	36	39	36	39	SHW needs to be explained.	Accepted, this abbreviation is not used in the new TS.
33621	TS	36	8	36	8	Low-carbon energy sources - does this include RE ? RE should be the first option.	Noted - this is discussed already in earlier chapters. It does include RE.
32275	TS	36	1	36	9	There are various alternatives to reduce energy consumption in building/housings and the economic return is an utmost factor for investment decision. A difficulty is that once an option (e.g. efficient air-conditioning) is deployed, the cost of additional measures (such as better insulation of walls or windows) needs significantly longer period to be recovered. This point needs to be explicitely discussed since this problem may need to be addressed by policy incentives such as subsidies and tax-reduction.	Noted. This problem is fully overcome by a systems thinking and applying holistic approaches to buildings rather than component-based ones. The chapter clearly documents the advantages of these but there is no space for this longer discussion in the TS.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33623	TS	37	1	37	2	Thermostat setting for cooling to 28 degrees can affect the comfort, productivity and health of employees in offices and does not comply with regulations in many countries. In very hot countries this could be feasible and accepted, so the reference is of importance.	Noted. The section has been rewritten and the discussed part removed.
39114	TS	37	16	37	16	Add "high performance" or some other equivalent descriptor before "low energy". Low energy buildings can be delivered in many ways that would be in direct conflict with the intent of this section regarding economically advantageous actions. For example, a low energy building could be attained by shutting off the outdoor air supply to save energy, but this would be conflict with the benefits noted in 9.7.2.3. and 9.7.3. Adding "high performance" helps clarify what type of low energy buildings are most appropriate and effective.	Noted. It is a good point but each terminology has its advantages and disadvantages, and hopefully the chapter clarifies our terminology.
39115	TS	37	19	37	19	$100-400/m2 at best is a regional example and shouldn't be presented as universal average.	Accepted - text completely rewritten
25032	TS	37	7	37	8	Suggested citation: Sustainability House (2012). Identifying Cost Savings through Building Redesign for Achieving Residential Building Energy Efficiency Standards. March 2012, prepared for the Australian Department of Climate Change and Energy Efficiency, http://www.climatechange.gov.au/publications/nbf/~/media/publications/nbf/identifying-cost-savings-thru-building-redesign-for-achieving-energy-efficiency-standards.pdf This study has showed how existing house designs could have thermal efficiency upgraded from 6 to 7 stars or better at zero or negative cost.	Noted - in the TS there are no citations.
29756	TS	37	12	37	13	add ', but' after '44%'	Text changed
31170	TS	38				BH line: there's a dangling "is" at the end of the Description line	Table has been deleted
25437	TS	38		39		Lots of typos in table. 1) Under "Technical Efficiency, BH": description is truncated. 2) Under "Systemic Efficiency, US" description not super clear. What's not yet commercially available? 3) In general, it would be nice to have sources referenced in this table.	Accepted - but table has been deleted.
29140	TS	38		39		These example seem far to explicit for a Technical Summary. Countries not included might ask why they are not there, given the prominence of this table. It may be more appropriate left in the full report and summarised or referred to in this summary.	Accepted - table has been removed.
39116	TS	38	1			To add reference: Xu et al. 2013 covering relevant savings from standard/retrofit/behavioral changes: Xu, P., T. Xu, P. Shen, 2013. Energy and Behavioral Impacts of Integrative Retrofits for Residential Buildings: What Is at Stake for Building Energy Policy Reforms in Northern China? Energy Policy, Volume 52, January 2013, 667-576	Noted - TS does not include references.
39117	TS	38	1			Can this information be summarized more concisely? It seems too detailed for the TS.	Accepted - text rewritten to be more concise
28864	TS	38	1	38	1	This table is interesting but could be deleted if the TS needs to be shortened. The fact that reductions in the building sector are substantial and economically feasible comes across well enough in the paragraphs before the table.	Accepted, table deleted.
26417	TS	38	8	38	8	Application field of the Technical Code of Buildings for Spain includes all the regions of Spain, not only Catalonia	Table has been deleted
35214	TS	38	7	38	7	Because that Hong Kong is not a sovereign state, it is suggested to change Hong Kong to be Hong Kong SAR. The modification should also be made to the content of the table on page 39 accordingly: HK to be HK SAR.	Noted - the table is deleted
29757	TS	38				"Envelope codes requiring well-insulated and efficient glazing is", incomplete sentence, please delete 'is'	Text has been rewritten
29758	TS	39				"DK, Energy consumption for H in new RS will be reduced by 30% in 2005, 10, 15, 20;" what does this mean?	Text has been rewritten
30681	TS	4	1	4	11	Consider deleting this Box. As noted within the Box, the messages are also captured by Boxes TS.2 and TS.8.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28686	TS	4	1	4	11	Box TS.1: The title of the box is promising, but its content is weak. It gives some examples for the time horizon and the discount rate, but a general and systematic overview of concepts and methods including associated uncertainties is needed here. Please improve and provide a definition of "assessment", and the concepts and methods used. In addition, the box currently provides information which is in more detail reflected in other boxes. The time horizon is taken up in box TS.2 and the discount factors in TS.8 in more detail.	Accepted - text revised.
28687	TS	4	1	4	11	Check whether this box is necessary. It provides information which is in more detail reflected in other sources, i.e.. Report of WG I and in other boxes of this document. The time horizon is taken up in boxTS2 and the discount factors in TS.8 in more detail.	Accepted - text revised.
30682	TS	4	14	4	15	1. A reference to Figure TS.3 should be included to support this statement. 2. A year - 2010, according to Figure TS.3 - should be given after the phrase 'At current levels'. 3. The phrase "is released" should be changed to "would be released" as this calculation is forward looking (i.e. from Figure TS.3, 2010 levels of ~32 Gt CO2 emissions mean that every 12 years, an amount equivalent to ~390 Gt CO2 would be emitted.	Accepted. We have revised the finding considerably, but changed from "is released" to "would be released". However, this is no longer part of the key finding, but rather in the body text.
21432	TS	4	14	4	15	This sentence is quite complicated with the reference to 12 yrs. Better give something based on 10 yrs, e.g. "At current levels, every 10 yrs we emit the same amount as in the past 35 yrs."	Rejected. It is not the impression of the authors that it is more complicated for the reader to think about 12 rather than 10 years. The finding will not work otherwise with regard to the emissions before 1970.
22825	TS	4	14		15	This sentence is very complicated with the reference to 12 yrs. Better give something based on 10 yrs, e.g. "At current levels, every 10 yrs we emit the same amount as in the past 35 yrs."	Rejected. It is not the impression of the authors that it is more complicated for the reader to think about 12 rather than 10 years. The finding will not work otherwise with regard to the emissions before 1970.
29102	TS	4	14	4	15	This ia very contrived headline for the first headline of the doucment. Why are we immediately using 1970 as an artificial marker? Using a more recent marker and comparison might make the document seem more "current". There are potential clearer headlines in the following sentences.	Accepted. We moved the finding downwards and change the key finding/headline.
23153	TS	4	15			1970 CO2 level was 325 ppm, 50 ppm over pre-industrial 275 ppm. In 12 years we emit about 18—20 ppm, less than half the cumulative pre-1970 emissions, contrary to assertion.	Rejected. The finding only refers to CO2 emissions from fossil fuel combustion - not all GHG emissions.
32209	TS	4	15	4	15	TS.2 put REF, as in the figure, instead of EIT	Accepted.
23154	TS	4	17			50.1 Gt CO2-equivalent emissions and 31.9 Gt CO2 emissions (Fig. TS-3) are not consistent with the statement (p. 4 line 19) that CO2 emission is > 75% of total CO2-equivalent	Rejected. The first estimate refers to GHG emissions. The second one to CO2 emissions from fossil fuel combustion.
39024	TS	4	17	4	17	Although it is defined elsewhere, the first mention of CO2eq should elicit a definition vs. CO2. A footnote would suffice to remind the reader, who may read nothing else but the TS.	Accepted - text revised.
28690	TS	4	17			This emission level of 2010 is already mentioned on the previous page, and it has been topped in 2011.	Noted.
29103	TS	4	19	4	23	The changes over time are represented in a different way for the F-gasses making direct comparison between changes difficult. It would be beneficial to frame these statistics in the same manner.	Rejected. It is important to highlight that they are consoiderably smaller than any other of the Kyoto gases.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28688	TS	4	2	4	6	The example on GWP100 is not balanced as it only mentions its weaknesses but not its strengths, please remove, or add ", but which have a smaller effect on stabilization of concentration levels, i.e. climate change, in the long run." In addition, the GWP is discussed in box TS.2.	Accepted - text revised.
39025	TS	4	20	4	22	It's worth pointing out that this increase since 1970 is driven almost entirely by the developing countries of the G20, as shown in Fig. TS.1	Rejected. This is a statement about global trends.
39026	TS	4	24	4	24	Copenhagen / Cancun commitments ought to be cited and discussed here as well. Limiting the discussion to Kyoto does a disservice to policymakers by not highlighting the important and drastically different framework adopted in Cancun/Copenhagen vs. Kyoto.	Accepted. We have generalized this finding.
40884	TS	4	24	4	26	It is a very important finding that the total amount of GHG emissions have been increasing between 2000 and 2010, in spite of the existence of UNFCCC. This part should be reflected in the SPM as well.	Noted.
28691	TS	4	24			Change to "and its Kyoto Protocol"	Noted. The finding is changed and more general in nature now.
29104	TS	4	24	4	25	'Policies' isn't the right word here - the UNFCCC and the Kyoto Protocol aren't policies. 'Despite existing policies and international agreements such as the Kyoto Protocol' would be better.	Accepted. The finding is changed and more general in nature now.
29105	TS	4	24	4	29	At individual country level some progress has been made reducing emissions over this time period. Recognition of this action may be beneficial here. Whilst not amounting to a reduction at the global level individual countries that have reduced their emissions have made a global contribution and global emissions increases would presumably have been greater still had this action not been taken.	Noted.
30683	TS	4	26	4	28	This statement requires supporting data. No decadal growth rates in GHG emissions for the periods referenced (2000-2010, 1990-2000, 1980-1990) are given in the text, and only the rate for 1970-1979 is given in FigureTS.1.To better support the text here, we suggest that decadal growth rates be added to Figure TS.1, and rates for other periods, be removed, other than for the specific time periods (events) represented by the coloured bars. Reference to Figure TS.1 should be added to this paragraph of text.	Accepted. This information has been added.
39027	TS	4	26	4	27	It's worth pointing out that this increase since 1970 is driven almost entirely by the developing countries of the G20, as shown in Fig. TS.1	Rejected. This finding is about the development in globale emission trends. Regional trends are treated later.
39028	TS	4	26	4	29	It is worth pointing out the more rapid growth trend for 2000-2010 despite of global economic recession experienced around 2008.	Accepted.
28689	TS	4	5	4	5	If box is not deleted, in any case: avoid a wording such as "climate pollutants"! For this, delete after "of" the term "climate pollutants such as methane and soot that have shorter time horizons" and insert after "of" instead: "methane and other pollutants, such as soot." Remark: Methane is a GHG and the term GHG is used all over the different chapters. Allocating Methane and pollutant as GHG is confusing. The atmosphere, the soil or water could be polluted, not climate.	Accepted - text revised.
31290	TS	4				Did some countries achieve significant GHG emission abtement over the period ? How much ? Is this replicable ?	Noted - text revised.
32386	TS	4	13	8	40	Please assure consistency with corresponding WGI Chapter 8, section 8.7 on Emission Metrics.	Accepted - text revised.
23027	TS	4	24	4	25	UNFCC and Kyoto protocol have been in existence for s long time yet they have not been effective in capping the GHG emissions. What is required in this explanation is why the failiar and strategies for rectification of the policies to ensure effectiveness.	Rejected. In this section the focus is on emission trends and drivers and not on effective policy design. There is a finding in section TS.4 on Kyoto.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25427	TS	4	16	4	18	"GHG emissions have continued to grow and reached an all-time high of 50.1 Gt CO2 eq in 2010…" Seems to imply that GHG emissions peaked in 2010. I'm not sure if this is accurate. Sources indicate CO2 emmissions continued to increase in 2011 (http://edgar.jrc.ec.europa.eu/CO2REPORT2012.pdf). I can't find an accurate statement indicating trends for all GHG emissions, but it seems that this statement is a reflection of the available data, not necessarily a result of declining GHG emissions between 2010 and 2013. Please clarify.	Accepted. We have changed the language.
26289	TS	4	26	4	28	It is not clear if the growth of emissions "(…) more than twice as fast than during the periods 1980-1990 and 1990-2000." is expressed in absolute or relative terms or if it is considered the rate of growing or the amount of CO2. See comment on SPM, page 3, line 36 to line 38.	Noted. We have changes this finding considerably.
31171	TS	40				really interesting and useful figure. Some components have words overflowing lines, and should be fixed.	Graphic designer will improve it
25033	TS	40	2	40	4	In addition to the measures listed, suggest including options of resource recovery and reuse, virtualisation (beyond improved materials efficiency) and shifting to alternative materials.	Thank you, most of these are covered in main chapter, revised TS is shorter and not all could be mentioned, but will ty to consider when revisiting the text
34750	TS	40	2	40	2	It is not clear what's the evidence for this claim. The underlying chapter (10) doesn't clarify.	Accepted, wording revised in chapter and TS
25662	TS	40	21	40	22	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table.	Due to space limitations this could not be included in revised version but it is covered in the main chapter
29141	TS	40	21	40	21	CHP needs to be explained	Accepted
30503	TS	40	4	40	6	"Product use efficiency as well as demand reductions for goods and services" are outside the scope of mitigation options in industry sector.	Rejected, the framework laid out in the chapter explains why they are within the scope of the sector
24421	TS	40	41	40	42	It reads social obstacles are crucial for product demand reduction, but there are many nations where products do not prevail widely. Under such situations, too simplistic discussion on product demand reduction would conflict with sustainable development policy.	Accepted, wording revised in chapter and TS
24420	TS	40	6	40	7	"product use efficiency as well as demand reductions for goods and services" are important mitigation measures from an economy wide standpoint but they are outside of the scope of measures in industry, so it would be inappropriate to be mentioned in the industry section. In Figure TS.22, "use of goods to provide services" should be put outside of the gray colored boundary for the same reason.	Rejected, the framework laid out in the chapter explains why they are within the scope of the sector
40925	TS	40	7	40	7	Please show some options other than energy efficiency improvement regarding mitigation policies in the industry sector.	Revised TS does so
28865	TS	40	9	40	9	This is a good figure but it needs some work: too many different fonts and strange hyphenation. For a broader use, it would be useful to remove the references to chapters from the figure.	Graphic designer will improve it
32276	TS	40	1	41	45	Some industry like chemicals may need to increase its GHG emissions to supply materials for energy saving (high performance insulation for example) or energy generation (PV for example) as the McKinsey report (http://www.icca-chem.org/ICCADocs/ICCA_A4_LR.pdf?epslanguage=en) says. Overall GHG not only from the industry but other sectors can be reduced by these means. This point must be discussed here to warn that compilation of sectoral minimization approaches may not bring about most efficient GHG reduction in the entire society.	Thank you, this is covered in Chapter 10 (including in the Ex. Summ) but the TS space allocation is too limited to cover this.
29759	TS	40	1	41	45	This section does not include [evidence, agreement]	Revised version does

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28866	TS	41	1	41	6	The text concerning HFCs refers to measures regarding refrigerants only although HFCs are not solely used as refrigerants. Secondly, replacement by alternative refrigerants is the most efficient measure to reduce HFC emissions while measures like leak repair will reduce emissions only slightly. Furthermore HFC-23 emissions result from different sources. Therefore it should be clear that the measure in this text only refers to one emission source. We propose to change the text to: Non-CO2 emissions from industry can be managed by changing practices: e.g. HFC refrigerant emissions by replacement by alternative refrigerants (ammonia, HC, CO2) or, to some extent, by leak repair, refrigerant recovery and recycling, and proper disposal; emissions of HFC-23 from HCFC-22 production can be reduced by process optimization and by thermal destruction, PFCs and SF6 can be countered by fuelled combustion, plasma and catalytic technologies; N2O emissions from adipic and nitric acid production through the implementation of thermal destruction and secondary catalysts.	Rejected - Reviewer provides no references to back the suggested change. Due to space limitations the revised TS contains a shorter paragraph on this issue. The details can be found in the main chaper.
21482	TS	41	20	41	45	This is a heavy paragraph that would need some restructuring	Noted, thanks. Revised TS is shorter and better structured
39118	TS	41	20	41	45	This paragraph is too long. Consider to condense or break into smaller paragraphs.	Noted, thanks. Revised TS is shorter and better structured
40927	TS	41	20	41	21	To recognize the reason for mitigation barrier is very important. Please summarize it in SPM as general problem.	Noted, lack of information mentioned in revised TS
29142	TS	41	20	41	45	Two of the main barriers that UK industry faces, but are probably not UK specific and not mentioned here in developing CO2 mitigation strategies are: a) Lack of engineers to implement the necessary changes. So priority is always given to keeping the production running; b) Different types of industry produce CO2 in different ways and at different concentrations. So there is no one 'off the shelf' technology that they can purchase to put on their process that will work. This Imperial paper neatly summarises the challenge: https://workspace.imperial.ac.uk/climatechange/Public/pdfs/Briefing%20Papers/Reducing%20CO2%20emissions%20from%20heavy%20industry_Briefing%20Paper%207.pdf	a) accepted, main chapter mentions this (e.g. Section 10.9), space limitations in TS do not allow an in-depth discussion. B) rejected, this is a general aspect for all sectors, in the industry chapter we have attempted to distinguish between cross-cutting options from sector-specific options
28867	TS	41	32	41	34	Please check the language of this sentence. As it is, it is really hard to understand.	Due to space limits statement no longer appears in current version
28868	TS	41	42	41	45	I suggest also adding the phenomenon of planned obsolescence.	This is too much detail for the Technical Summary. Due to space limits statement no longer appears in current version
40926	TS	41	9	41	10	Importance of new steels and production techniques should be highlighted. In this regard, this part should be maintained while it would be better to describe it other part than recycling.	This is too much detail for the Technical Summary. Due to space limits statement no longer appears in current version
32277	TS	41	20	41	45	Barriers to investment include uncertain market and regulations. Fuel and material prices and supply stability as well as government regulations or policies are factors of ucertainties just to name major examples.	Noted but due to space limitations these are not covered in the TS. They are mentioned in main industry chapter (e.g. Section 10.9), and hopefully policy chapters cover them too as an overarching issue.
40930	TS	42				In addition to crop/grazing lands and forests, other sinks such as wetlands should also be discussed. The inventory guidelines currently being developed also places importance on the assessment of wetlands, etc.	Noted. Other sinks are presented the main text of the chapter. In the TS, the most significant were mentioned.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40929	TS	42				For Figure TS.23, the premises given in each paper should be made clear and the descriptions provided in the figure should be rearranged to facilitate understanding.	Partially accepted. A narrower range of mitigation potential is now presented (together with the full range) in the tex after considering studies with more similar assumptions or mitigation measures.The figure is very helpful by showing the new studies since AR4 and economic potentials under different ranges of C prices. The figure was revised to present the mitigation options in the x-axis.
39119	TS	42	1	42	1	What is AFOLU? Spell out this acronym in all headings and sub-headings.	Partially accepted. Suggestion partially accepted. Acronym was spelled out in the main heading
39120	TS	42	1	45	31	Productivity enhancement is a (supply-side) category of mitigation activity that merits greater prominence in the discussion, analogous to the other categories of supply-side activities (changes in land management and land use) and demand side activities ("reducing waste" and "changing food diets“ ie, reducing demand for livestock").	Accepted. Productivity enhancement with reductions in emissions per unit of product (emission intensity) was added to the TS
25438	TS	42	11	42	19	What do you mean by economic mitigation potentials? Is this relating to carbon prices? Or the cost to mitigate a certain amount of carbon per year? Please clarify.	Noted. Economic mitigation potential is used throughout the entire volume and is not a term specific to the AFOLU sector. All economic mitigation potentials are quoted at a given CO2eq price, and a definition is also given in the main text of the chapter ("By comparison, economic potential refers to mitigation that could be realised at a given carbon price over a specific period, but does not take into consideration any socio-cultural (for example, life-style choices) or institutional (for example, political, policy and informational) barriers to practice or technology adoption. "
40928	TS	42	11	42	13	A corresponding statement is found at the ES part of Chapter 11[P41. L35-L40], but with reference to a different section [11.6]. The descriptions in the chapter that support this level of evidence should be appropriately referred to.	Accepted. Paragraph and level of evidence were revised.
28872	TS	42	11	42	13	The sentence should not be in bold, as the statement has limited evidence and medium agreement only. This is quite weak. It would even be preferable to replace it by a sentence withe higher evidence and agreement or splitted in parts of higher evidence and lower ones.	Accepted. Paragraph and level of evidence were revised.
28873	TS	42	16	42	16	clarify diet for whom? Human? Animal? Both?	Accepted. Human diet - clarified and paragraph rewritten.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21483	TS	42	20			The studies presented in the Figure are too different from each other and are NOT comparable. The studies should not only be distinguished by bottom-up and top-down. The ongoing model inter-comparison project (AG-MIP) shows that these models and many others are very different wrt 1) assumptions of basic land endowment (incl. "spare land"); 2) Assumptions on technological progress 3) Set of mitigation technologies 4) Price assumptions and linkage to the rest of the economy (e.g. arbitrage with bioenergy market) 5)Cost allocation to CO2 in poly-production systems and costing methodology (incl. discounting) 6) Degree of competition for land. Conclusion: The studies shown in the Figure are too inconsistent to be shown in a single figure! Omit the Figure!	Partially accepted. A narrower range of mitigation potential is now presented (together with the full range) after considering studies with more similar assumptions or mitigation measures. The figure was revised to use footnotes for references. These are full sectoral potentials covering the cumulative potential of a wide range of measures, so do not represent individual mitigation options on the x-axis. The figure is very helpful by showing the new studies since AR4 and economic potentials under different ranges of C prices. Demad side measures are now clearly shown separately. Difference between the models, assumptions and GHGs considered is acknowledged in the figure caption and the main chapter text.
39122	TS	42	20			The usefulness of this figure would be improved if the x-axis publications were replaced with mitigation actions, such as cropland management or grazing land. Focus on the individual papers tells us little about the costs at which various mitigation actions become feasible or how the mitigation portfolio varies with carbon price.	Partially accepted. A narrower range of mitigation potential is now presented (together with the full range) after considering studies with more similar assumptions or mitigation measures. The figure was revised to use footnotes for references. These are full sectoral potentials covering the cumulative potential of a wide range of measures, so do not represent individual mitigation options on the x-axis. The figure is very helpful by showing the new studies since AR4 and economic potentials under different ranges of C prices. Demad side measures are now clearly shown separately. Difference between the models, assumptions and GHGs considered is acknowledged in the figure caption and the main chapter text.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39121	TS	42	20			The side by side of the demand-side measures with the supply-side measures is very misleading since the latter is technical potentials and the former economic potentails. Figures need to stand alone and so at a minimum a table note is needed clarifying that the demand side technical potentials would be significantly reduced if they were ajusted tio accommodate economic potentials. Alternatively a table could be constructed with technical potentials of both the supply- and demand- side measures.	Partially accepted. Demand side measures are now clearly shown separately. Difference between the models, assumptions and GHGs considered is acknowledged in the figure caption and the main chapter text.
28871	TS	42	4	42	5	delete "could" insert "might". Insert after "but" "more research is needed to learn more about the mitigation potential, co-benefits and risks, opportunities and barriers.	Comment does not match with the text in the referred page and lines. All text revised.
31374	TS	42	5	42	10	The figure 5.3 Gt CO2 eq/yr for emissions from agriculture is given for all GHGs for the period 2000-2009. The figure for 2010 however, 5.4-5.8 Gt CO2eq/yr is given for non-CO2-emissions . Would it be possible to confirm that the emission figure for 2000-2009 is an average for that period and further give a figure for 2010 that comprises all GHGs, including CO2 from land use. This will be usefull for comparing.	Accepted. The emission figure for 2000-2009 is na average for that period. Regarding the number for 2010, emissions from agriculture are largely dominated by non-CO2 gases (N2O from agricultural soils and CH4 from livestock and manure management).
30720	TS	42	5	42	10	It's not clear how to relate the finding that in 2010, there were 5.4-5.8 GtCO2-eq of non_CO2 gases (primarily methane and nitrous oxide) emitted from agriculture, to the line above saying the total GHG emissions from agriculture were 5.3 Gt CO2-eq /year over the 2000-2009 period. This text would seem to suggest that net emissions of CO2 from agriculture are negligible. If so, adding a statement to this effect would be helpful.	Accepted. The emission figure for 2000-2009 is na average for that period. Regarding the number for 2010, emissions from agriculture are largely dominated by non-CO2 gases (N2O from agricultural soils and CH4 from livestock and manure management).
32721	TS	42	1	45	5	The subject of bioenergy receives a great share of attention. This does not seem justified in light of the (technical) potential of other measures, particularly demand side measures.	Noted. Although recent estimates indicated the importance of demand side measures, this topic is stil under researched and uncertainties are high. On the other hand, contribuiton of bioenergy is projected to potentially be a significant component of transformation pathways simulated by integrated assessment models, so the implications of need to be covered in the section on land based mitigation.
28869	TS	42	1	45	5	The section is very long. It would be good to mention more often within the section that the information relates to AFOLU sector.	Accepted. Most of the subheadings include the acronym AFOLU or some activity that is directly related to sector.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28870	TS	42	1	45	5	What is most striking about the new calculated mitigation potentials of the AFOLU sector is the huge range in estimates. The difference between the low end and the high end is two orders of magnitude! This should highlighted and commented in the TS.	Accepted. A narrower range of mitigation potential is now presented (together with the full range) after considering studies with more similar assumptions or mitigation measures.
32720	TS	42	17	42	19	The sentence contradicts itself: " […] provides headroom for the development of mitigation technologies […] as the technologies already exist […]"	Accepted. This sentence was excluded in the revised version.
21424	TS	42	1	42	1	Suggest providing the full name of AFOLU.	Accepted.
29143	TS	42	2	42	2	On Page 4 line 17 the total global emissions are estimated at 50.1Gt CO2e - if AFOLU is 9-10 Gt then this is significantly less than a quarter of emissions, closer to 20% or a fifth.	Accepted. Numbers revised are presented, 24% of total global anthropogenic emissions.
29144	TS	42	6	42	10	Inconsistency between central estimate of agricultural emissions in 2010 (5.3Gt) and non-CO2 emissions in the range 5.4 - 5.8. If the latter includes non-agricultural sources of non-CO2 emissions the text needs clarifying a bit	Accpeted. The emission figure for 2000-2009 is na average for that period. Regarding the number for 2010, emissions from agriculture are largely dominated by non-CO2 gases (N2O from agricultural soils and CH4 from livestock and manure management).
28879	TS	43				See our comments in SPM on this figure.	Accepted. The figure is very helpful by showing the new studies since AR4 and economic potentials under different ranges of C prices. Demand side measures are now clearly shown separately. Difference between the models, assumptions and GHGs considered is acknowledged in the figure caption and the main chapter text.
31375	TS	43	1	43	24	In line 1-2 the global economic mitigation potential in 2030 of supply-side measures is estimated to 0.49-10,60 GtCO2-ekv (100 USD/t) In line 13-15 changes in diet is estimated to a mitigation potential of 0.76-9,31 GtCO2-eq in 2030. Could it be clearified in which degree these potentials can be combined in a figure for 2030? And what with the combined effect of supply-side and demand-side measures in 2050?	Partially accepted. This estimated is still hindered by the large uncertainty about the mitigation potential of demand-side options. Demand side measures clearly seprated from supply-side measures in the final figure
21484	TS	43	1	43	3	Estimates of cost-effective mitigation potential are only provided for AFOLU but there are estimates of the mitigation potential in Gt CO2e/yr by 2020 or 2030 at certain carbon prices for other sectors by regions. These findings must be visible.	Thanks for the comment. This should be addressed by other sectors as it is already stated here.
31376	TS	43	13	43	15	Please check with SPM page 20 line 6-8 where this finding is given low evidence, not medium evidence	Accepted. This was checked to make the summaries consistent
28874	TS	43	13	43	13	clarify diet for whom? Human? Animal? Both?	Accepted. Human diet. Clarified

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28875	TS	43	13	43	15	do not highlight this finding, it is of limited evidence and low agreement!	Partially accepted. The paragraph was revised. Considering that demand-side measures is a new aspect in AR5 in comparison to AR4, the statement was highlighted in the summary even with limited evidence (few studies). The new sentence points out the demand side measures are under-research but mitigation potential could be substantial .
28876	TS	43	18	43	25	The change presented is compared to conditions of 2010? What is the "mitigation reference case"?	Accepted. Table has been removed.
29147	TS	43	18	43	24	Caption to Table TS4: depending on the nature of the bioenergy crop, mitigation can be achieved through increasing carbon stocks as well as through substituting for fossil fuels. The caption (mutually exclusive) indicates that this is not the case. The magnitude of this additional mitigation potential should be mentioned. Moreover, the only mention of mitigation from sector through fossil fuel substitution is direct substitution. The potential for harvested wood products to store carbon and reduce fossil fuel emissions indirectly needs to be mentioned.	Accepted. Table has been removed.
29145	TS	43	2	43	2	The unit 'yrat' would benefit from an explanation.	Accepted. It was a typo. The correct text is "GtCO2eq/yr at carbon prices..."
29148	TS	43	24	43	25	This table should show a range of food crop areas related to each case, rather than one number. There is not enough certainty to give these figures without a range or error. For example, yield crop increases are highly uncertain. Also what are the assumptions about global population in 2050?	Table has been removed.
28877	TS	43	25	43	25	clarify diet for whom? Human? Animal? Both?	Accepted. Human diet.
28878	TS	43	26	43	27	This sentence is a generalization and quite self evident, i.e. not helpful. More information should be added, it should not be printed in bold.	The sentence is important to clarify that LCA results always need to be considered in context. It is absolutely crucial to see that there is not 'good' or 'bad' bioenergy in general, but always in the specific. We need this statement; avoiding generalizations is a main message that is often not heard.
39123	TS	43	7	43	12	Is this ignoring forests?	Accepted. The paragraph was revised and mitigation options for Agriculture and Forest/Forestry are highlighted.
32722	TS	43	13	43	15	The relationship between the first (demand-side measures) and the last part of the sentence (assumptions about the implementation of bioenergy) is not clear.	Accepted. Text was revised and the mention of bioenergy was deleted
32723	TS	43	27	43	30	Land-use change emissions etc. not only impact the total attributional life-cycle emissions of bioenergy use, but also of many other mitigation measures.	Bioenergy is about a factor 100 more land use intensive than other renewable energies. Hence LUC need to be specifically considered for bioenergy (and other AFOLU measures)

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29146	TS	43	8	43	8	Unclear what is meant by cropland and grazing land management - all agricultural land is under management (doing nothing is a management decision). It would be helpful to clarify what these options mean. Measures to increase soil carbon sequestration in cropland remaining cropland and grassland remaining grassland are thought to be limited in the UK context (see for example Powlson, Whitmore and Goulding (2011) "Soil carbon sequestration to mitigate climate change: a critical re-examination to identify the true and the false" doi: 10.1111/j.1365-2389.2010.01342.x); it would be useful to note the regional constraints to such approaches. Furthermore the risk of permanence and stability of the sink should be noted i.e. change in management practice could result in losses of sequestered carbon, as could future climate change. As such I would regard the benefits of agricultural land amnagement as highly uncertain.	Detailed information on mitigation options and permanence are presented in the main text of chapter. Unfortunatelly it is not possible to present particular cases (UK context) in the TS. Different measures to manage croplands and grasslands could increase soil carbon content under diverse contexts.
29732	TS	43 of 59	35	44 of 59	2	The claim that “available data suggests a differentiation between options that offer low life-cycle emissions under good land-use management (e.g. sugarcane, Miscanthus, and fast growing tree species” appears to be based on predictions of direct land-use change and other direct emissions only. Indirect land use change impacts depend on overall demand on land, not specific management practices or crops. There is evidence of significant indirect land use change emissions from Brazilian sugar cane ethanol and there is also evidence of the impact which a large-scale bioenergy programme based on ‘cellulosic biomass’, such as miscanthus can be expected to have on land use change and carbon emissions. See, David M. Lapola et al., "Indirect land-use changes can overcome carbon savings from biofuels in Brazil," PNAS, Vol 107, no. 8, 8th January 2010. This study models land-use changes which would result from an increase in sugarcane ethanol and soy biodiesel production by 35(4) x 109 litres from 2003 to 2020. It finds that “direct land-use changes will have a small impact on carbon emissions because most biofuel plantations would replace rangeland areas. However, indirect land-use changes, especially those pushing the rangeland frontiers into the Amazonian forests, could offset the carbon savings from biofuels. Sugarcane ethanol and soybean biodiesel each contribute to nearly half of the projected indirect deforestation of 121,970 km2 by 2020, creating a carbon debt that would take about 250 years to be repaid using these biofuels instead of fossil fuels.” See also, Saraly Andrade et al., "Dynamics of Indirect Land-Use Change: Empirical Evidence from Brazil," (January 16, 2013). CER-ETH – Center of Economic Research at ETH Zurich Working Paper 13/170. This paper looks at potential indirect impacts from sugarcane expansion in Sao Paulo state on the Amazon forest. Its “results suggest a positive relationship between sugar cane expansion and deforestation”, through a dynamic process over 10-15 years. Indirect impacts of sugar cane expansion on deforestation by means of sugar cane displacing cattle into the Amazon was found to be statistically significant. Sugar cane expansion was found to correlate with lower cattle numbers in Sao Paulo state, which in turn was found to correlate with greater cattle numbers in the Amazon, responsible for more deforestation. See also, Jerry M. Melillo et a., "Unintended Environmental Consequences of a Global Biofuels Program," MIT Joint Program on the Science and Policy of Global Change, Report No. 168, January 2009. The authors looked at the implications of a global biofuels programme based on cellulosic biofuels, the feedstocks for those would be expected to include miscanthus and short-rotation forestry. The study is based on a computable general equilibrium model of the world economy, the MIT Emissions Predictions and Policy Analysis Model and the Terrestrial Ecosystems Model to explore environmental consequences of an aggressive global cellulosic biofuels program up to 2050. The study concluded that the total (direct and indirect) carbon debt from the first scenario would be up to 103 billion tonnes by 2050 and that from the second scenario up to 34 billion tonnes. The study also concluded that the more optimistic 'intensification scenario' would see the loss of 3.4 million km2 of grasslands currently used for grazing, 38% of the natural forest cover and 38% of wooded savannah in sub-Saharan Africa based on 2000 figures. In Latin America, the same scenario would be associated with the loss of 20% of natural forests and savannah in Latin America. According to the authors: “These losses [in both scenarios] have the potential to put thousands of endemic plant and animal species at risk across the globe, especially in the sub-tropical and tropical regions...The increases in co-opted NPP coupled with the loss of biodiversity have the potential to diminish the capacity of terrestrial ecosystems to deliver many of the support services that humans rely on, such as the cleansing of air and water. We currently do not understand the relationships between ecosystem structure and function we	There are wide disagreements on the signficance of this literature. The statement reads "The available data suggests a differentiation between options that offer low life-cycle emissions under good land-use management (e.g. sugarcane, Miscanthus, and fast-growing tree species) and those that are unlikely to contribute to climate change mitigation (e.g. corn and soybean), though disagreements, particular with respect to consequential analysis, remain abundant." This properly reflects the wide divergence in the literature.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39124	TS	44	13	44	14	This statement mischaracterizes the problem, and isn't possible in a non-biased manner. The total bioenergy "potential" is not some limited amount beyond which additional production is non-sustainable. Very low volumes could have large negative impacts, while very high volumes might be fine. This sentence needs re-written to reflect this nuanced understanding.	That is correct. We deleted the wording "potential". The paragraph was not intending to provide an interpretation on potentials. It reads now "Further research is needed to evaluate the schemes that sustainably improves rather than harms livelihoods. "
31378	TS	44	15	44	21	The first sentence in bold and the last part of the paragraph is not necessarily in the text in the body of the paragraph nor in chapter 11.11 which it refers to. We assume that imperfect policy conditions need further considerations for more sectors than bioenergy. Does it mean that bioenergy here is used as one example where imperfect policy conditions needs further consideration?	That paragraph has been deleted.
31379	TS	44	15	44	21	GHG emissions form bioenergy will depend on the timescale, e.g. how article 2 in the climate conventionis interpreted.	That paragraph has been deleted.
28880	TS	44	22	44	23	The uncertainty qualifier seems to relate to the whole sentence, but is there only medium confidence, that bioenergy offers significant mitigation potential? Please clarify.	Both bottom-up studies and integrated assessments allow for the possibility that bioenergy remains an imperfect mitigation technology; under specific circumstances the potential remains limited.Not every author of the crosscut would subscribe to the sentence with high confidence.
25663	TS	44	23	44	31	This part should explain that it is uncertain whether BECCS can be utilized in the future, as described in the section TS.3.3 (page 21, line 37). Safety confirmation, affordability and public acceptance are indispensable in CCS site selection. There is a much higher barrier to adopt BECCS than CCS because BECCS requires stable biomass supply for generation at reasonable cost. Since feasibility for BECCS has not been established so far, it is not appropriate to expect huge potential for BECCS in the future, as described in (Rhodes, 2008, page323). This literature is listed in the No7 line of this table.	BECCS is treated in another part of the TS now. One line there reads: "Potential, feasibility and costs of BECCS remain highly uncertain with some integrated assessment models being more optimistic than bottom-up studies."
28881	TS	44	25	44	26	Please add ranges and uncertainty statements.	ok
29150	TS	44	25	44	25	The unit 'EJ' would benefit from an explanation.	Editorial decision.
39125	TS	44	26	44	26	Add current bioenergy deployment stats alongside with the 15-225EJ projected... how does the projected compare to current? 5X increase? 10X? Need the context to understand the projection.	The contextualization of the technologies and comparison with today's values is given before.
28882	TS	44	30			Same comments as for the SPM.	Accepted. The figure is very helpful by showing the new studies since AR4 and economic potentials under different ranges of C prices. Demand side measures are now clearly shown separately. Difference between the models, assumptions and GHGs considered is acknowledged in the figure caption and the main chapter text.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40931	TS	44	31			Land carbon (forest) protection should be changed to "land (forest) conservation" because conservation is a wider concept than protection, and mitigation can be realized not only by land protection but conservation.	That paragraph has been deleted. At another point, the text specifies the protection of "high carbon density ecosystems"
28883	TS	44	35	44	37	Are all these barriers of the same importance? If not, please indicate in order to increase the usefulness of the report.	Accepted. Text was revised
29151	TS	44	40	45	5	The sections on sustainable land management and policies supporting sustainable land management do not make it clear that, for example in the case of sustainable forest management, mitigation can be delivered in other sectors (energy, industry) on an ongoing basis, while maintaining carbon stocks (albeit at reduced levels compared to unmanged forests) and supporting biodiversity, the livelihoods of indigenous peoples and a range of other ecosystem services. In short, the text is too 'high level' and non-specific.	Accepted. Text was revised
31380	TS	44	41	44	42	Very informative finding	Noted. thanks for the comment.
31381	TS	44	44	44	46	Very informative finding	Noted. thanks for the comment.
31377	TS	44	8	44	9	Very informative conclusion	Noted.
29149	TS	44	8	44	14	Need to mention that increased bioenergy deployment carries the risk of 'land grabbing', where indigeous people are moved from their land, severely affecting their livelihood. This needs to be prevented.	Such a statement is perceived to be conflictual for some authors and governments.
32724	TS	44	3	44	4	Land- and livelihood-related concerns need to be comprehensively integrated not only when considering bioenergy development, but also when considering any other mitigation measure.	Arguably, because of the high land use demand of bioenergy these concerns are more prevalent for bioenergy.
32725	TS	44	38	44	39	The sentence may be completed in the following way: "[…] that allow the delivery of multiple services from land, increase resilience and reduce risks."	Accepted. Text was revised
31382	TS	45	1	45	5	Very informative finding	Noted. thanks for the comment.
21485	TS	45	1	45	5	"The implementation of REDD mechanisms … cost effective option with high social and other environmental co-benefits" seems in contradiction with statement in SPM of WGII p17 line 38 "mixed or potentially detrimental impacts"	Accepted. The paragraph was revised and now mentions "potential cobenefits" and that sucessful implementation would consider a set of safeguards (social, environmental)
25439	TS	45	12	45	18	This statement could be misleading. How does energy use in urban areas break down per capita? In some contexts, the high population density increases energy efficiency.	Noted: Refined statements are provided in the new version of TS.
21486	TS	45	14			"In contrast, consumption-based allocations show a few wealthy cities contributing to a majority of the emissions" The contrast with preceding sentence not very obvious	Taken into account: texts are modified and refined
39127	TS	45	19	45	20	The authors should consider deleting the phrase "with multifamily or single family homes," as it sets up an either/or dynamic that does not exist. Most places develop with both types of housing.	Taken into account: The phrase no longer exists in revised TS
39128	TS	45	22	45	22	Editorial comment: "that that" should be "that"	Editorial
28884	TS	45	23	45	45	The question of urban heat islands is subject to WGI and of scientific debate. The statement here is an oversimplification and should be refined according to WGI results. In addition the reference to [12.1] is not correct.	Taken into account: The urban heat island related studies are not in the revised TS
40932	TS	45	27	45	28	It is very important to point out "lock-in" effect on life-style and consumption patterns. Maintain this part.	Noted: In revused TS, we have used word behaviour to reflect consumption and lifestyle

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39129	TS	45	30	45	30	Suggest replacing "built environmental materials" with "public amenities" to make the definition consistent with the definition provided in 12.1, page 5, lines 24-25. Also, it is unclear what the phrase "(co-located homes, businesses and industries)" is referring to. If it is in reference to the community, suggest removing "co-located" as that adds to reader confusion.	Taken into account: TS texts are change
24157	TS	45	32	46	39	An impact of climate policy on sustainable development in the cement industry is missing. So, please refer to "co-benfit" providing from two literatures of (Susumu Sano, Akira Kato, Tomoyuki Iino, Nobuo Kasiwazaki, Toshihiko Matsuto and Nobutoshi Tanaka, Journal of the Japan Society of Material Cycles and Waste Management, Vol.16, No.5, p.341, 2005 “Effects of CO2 Emissions from the Utilization of Municipal Solid Waste as Alternative Fuel and Raw Materials in Cement Production”) and (MORIMOTO, NGUYEN, CHIHARA, HONDA and YAMAMOTO; Journal of Life Cycle Assessment, Japan, Vol.2 No.4 October 2006 "Proposals for Classification and an Environmental Impact Evaluation Method for Eco-Services: Case study of Municipal Waste Treatment in Cement Production").	Thank you, Morimoto reference now used in industry chapter.
22847	TS	45	44			I wouldn't mention a specific study here (Global Burden Desease study) because at no other place a specific reference is mentioned	Suggested: Taken into account - text revised
28885	TS	45	44			Reference for Global Burden of Disease study?	Suggested: Rejected: The TS does not give literature reference but only reference to sections where the references are displayed.
39126	TS	45	6	45	31	In the second paragraph of this text region: "urban areas produce between 60 - 80% of global emissions" -- of energy-related CO2 emissions, not total GHG emissions. Please be very explicit here with the units -- it matters a lot whether the analysis is including all sector emissions and all GHGs, especially CH4, which changes the urban-rural splits on GHG emissions. A larger point on this section: how much does transportation account for global GHG emissions? It seems that an inordinate amount of attention is paid in this chapter to transport emissions.	Taken into account: Robust analysis and information is provide on this issue in the TS, SPM as well as chapter texts in new versions. Marcotullio et al 2013, IEA 2008 and Grubler et al 2012 (Global Energy Assessment) are key materials here. The new statements are the followings "Urban areas account for more than half of the global primary energy use and energy-related CO2 emissions (high agreementconfidence, medium evidence). The exact share of urban energy and GHG emissions varies with emission accounting frameworks and definitions. Urban areas account for 67%-76% of global energy use and 72 %-76% of global energy-related CO2 emissions (Figure TS.3.2.12 TS.Z). [12.2, 12.3]
28886	TS	45				Please add uncertainty statements wherever possible - here and throughout the report.	Taken into account: Added at the place needed
28887	TS	45				This section should also mention adaptation as an objective that affect decisions on mitigation options.	Suggested: Accepted - text revised
33958	TS	45	22			“that that”	Editorial – copyedit to be completed prior to publication

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20048	TS	45	36			Replace " and to avoid trade-offs" with ",taking into account trade-offs", as the problem is to maximize utility of a society, balancing marginal utility of each objective and taking trade-offs into account, where trade-offs almost always (unavoidably) exist.	Accepted, the formulation of 'avoiding trade-offs' has been avoided for the TS.
26303	TS	46		46		In the "nuclear replacement coal and power" row, under the economic column, energy security (import independence) appears as a benefit. Nonetheless, for many countries, uranium, as for oil, is an imported fuel, and the fact that today is not scarce, does not guarantee that will be the case in the future.	see ch7 comment 20894
26304	TS	46		46		in the "fossil CCS replacing coal" row, under the "economic" column, it is stated that the CCS technology could be better than variable and unpredictable RES. With current weather forecast solar and wind energies are predictable with a high confidence. I suggest to delete "unpredictable" and keep only "variable".	Taken into account. Please note that the table has been edited for brevity and this specific statement has been deleted.
21487	TS	46	1	46	9	the major co-benefit which is reducing air pollution from the burning of coal and oil should be mentioned at this stage	Suggested: Accepted - text revised
40933	TS	46	1	46	1	Since argument on air pollution from solid fuels appear in many parts, they should be summarized briefly.	Suggested: Accepted - text revised
39130	TS	46	10	46	17	This section discusses the co-benefit of energy security with climate mitigation actions. It seems to imply that reduction in global energy trade will increase energy security. Is this meant to be implied? If so, please show that trade automatically reduces energy security.	Suggested: Taken into account - text revised
25034	TS	46	18	46	25	Suggest clarifying the distinction between the need for energy and the need for 'energy services' or services to which energy is an input. By considering energy efficiency, fuel switching and cultural change, energy services can be provided with much lower energy use and, often, additional benefits such as improved indoor air quality. It is important to recognise that the poor and developing countries need services, not energy per se, and the challenge is to provide those services with minimum climate impact and maximum benefit. So making the price of energy higher does not necessarily adversely impact on the poor if services can be provided more efficiently or via other mechanisms.	Suggested: Taken into account - text revised
22904	TS	46	18	46	25	KEEP this para as it is important to highlight adverse side effets as well	see SPM comment 22886
21488	TS	46	18	46	18	The text on the adverse effects of climate action (increasing the costs of energy, creating risks that impede access to energy for the poor) overlooks literature describing the feasibility and low costs of providign universal access to energy at the same time as cutting emissions, like research by IEA or reported by UNIDO.	Suggested: Taken into account - text revised
34751	TS	46	18	46	25	This paragraph, or the bolded sentence, seems a bit misleading, in the context of energy access for the poor. Today decentralised renewable energy is often the most economic solution for providing energy access for the poor. According to a recent, broad study by the International Renewable Energy Agency: "renewables are increasingly becoming the most competitive option for new grid supply and swift grid extension. Where electricity systems are dominated by oil-fired plant, cheaper—sometimes significantly cheaper—renewable generation choices are available. For off-grid power supply, renewables are already the default economic solution."So mitigation doesn't necessarily mean higher energy prices." (Renewable Power Generation Costs in 2012: An Overview. IRENA Report. 2013. Available online: www.irena.org)	see SPM comment 34716
25054	TS	46	18	46	25	Keep this paragraph.	see TS comment 22904
28888	TS	46	18	46	25	This para again gives a very negative impression on mitigation action indicating that it will be first of all cost more and thus have adverse affects on the poor. The SRREN was more optimistic on the affects of RE for developed countries, see e.g. regarding the access to energy or co-benefits. Please reformulate the para in a more balanced way.	see TS comment 21488

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22421	TS	46	19	46	23	Increases in energy costs affects not only people in developing countries but also those in developed countries. It is significantly important to provide affordable energy worldwide so as to conserve well-beings of everyone in the world. Thus following sentence shoud be added after the sentence ending with "technologies"."And at the same time, it is significantly important to provide affordable energy, not only developing countries but also developed countries, so as to conserve well-beings of people living in relative poverty in developed countries."	Suggested: Taken into account - text revised
28889	TS	46		45		Insert a para extracted from 11.6 which deals with what is most striking about the new calculated mitigation potentials of the AFOLU sector the huge range in estimates. The difference between the low end and the high end is two orders of magnitude! This should be highlighted and commented on in the TS.	Accepted. A narrower range of mitigation potential is now presented (together with the full range) after considering studies with more similar assumptions or mitigation measures.
26611	TS	46	28		28	This paragraph implies that all turbined water is no longer available for other uses. In fact, water run through a hydropower turbine is non-consumptive, that is it is unchanged and can be used again for many other purposes. Furthermore, hydropower reservoirs frequently make water MORE available for multiple purpose (such as irrigation, transportation, recreation) than it was before the reservoir, not less available. Furthermore, it is unclear how a reservoir could increase demand for water, when it is a supply measure.	Suggested: Accepted - text revised
34789	TS	46	26	46	29	Technical Summary p.46. I think that this statement "The effect of mitigation on water demand … may contribute to an increase in water demand." is ambiguous in its current writting. Indeed according to UNESCO-IHE, Octobre 2011, Accounting for water scarcity and pollution in the rules of international trade, research Report Series No. 54, Editors: A.Y. Hoekstra, M.M. Aldaya, B. Avril ; Authors: J. Granit and A. Lindström, Stockholm International Water Institute, Stockholm, Sweden "Opposing perspectives on the extent to which water is “consumed” during its use for energy production, and in particular during its use for hydropower production, have resulted in a wide range of estimates on the topic. In the case of hydropower, different production technologies such as run-off-the-river plants use no or relatively small water reservoirs. When water is stored in reservoirs, however, some water will be consumed due to evaporation. How much water that is consumed depends on several factors, such as the surface area and depth of the reservoir and local climate conditions (Glennie et al., 2010). References on water consumption in hydropower production display the broadest range of consumptive values amongst the different power producing technologies presented in this paper varying from negligible amounts of water consumed to values above 200 m3/MWh (IPCC, 2011F). Reservoirs for hydropower are often used for multiple purposes and consumption related to other uses is difficult to distinguish in the existing data. This means that the figures on consumptive water use for hydropower might be considerably less then what is often reported (Ibid)."	Suggested: Taken into account - text revised
20049	TS	46	39			Insert a block after line 39 or somewhere appropriate, which corresponds to p.13 line 25-32, to explain the needs for comprehensive evaluation and status quo of such evaluation.	Suggested: Rejected - redundancy should be avoided but cross-references has been inserted.
20838	TS	47				"Local employment and value added at the place of deployment" is written as one of the RES's social objectives. However, it is not peculiar to RES. Nuclear, CCS(including BECCS) have this feature. This lacks of the balance among zero-emission energy-sources.	see ch7 comment 20849
25571	TS	47				According to NEA/IEA, Projected Costs of Generating Electricity-2010 Edition, the LCOE (5%) of Nuclear power is lower than that of coal power in many cases. However, the table describes "increases the cost of electricity generation" for nuclear replacing coal power. This will be inconsistent with the literature. The sentence should be revised.	see ch7 comment 25589

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
31383	TS	47				Row 2 (RES), column 5 (environmental effects):Wind power can also have adverse effects on biodiversity, both directly (e.g. birds colliding with physical structures) or indirectly through habitat loss	Taken into account. Please note that there is no agreement in the literature to what degree these impacts are serious and unavoidable and how large these impacts are compared to those of coal, as is now noted.
25606	TS	47				It is appropriate to replace the all expression "replacing coal" and "replacing coal power" in this table by "replacing fossil fuels" because of the reasons shown as bellow. 1)Chapter 7 mentions "for climate change, it is carbon endowment potentially available for combustion that matters."(P17 L19). 2)Also Chapter 7 mentions "the degree to which low carbon options may or may not contribute to energy security is dependent on the local resource situation and specific national economic circumstances and social priorities."(P45 L13-).This means replacing coal does not necessarily the way to be taken. 3)In this table, RES is to be replacing from fossil fuels.	Taken into account. Please note that we need to have a reference for comparing the low-carbon technologies with, and since gas, oil and coal power are quite different in their attributes, we chose the dominant one for comparison.
25607	TS	47				Affordabillity in the Nuclear replaceing colum shoud be changed to black color as it depends on the replacing fuel.	Taken into account. Statement removed.
41075	TS	47		47		"Fossil CCS replacing coal" should read "Fossil fuels with CCS replacing non-CCS coal"? Why no % change per year? I think it has increased in rate (though the total amount might still round down to zero Gt). Also Ch6 p 62, and Table 7.4.	Rejected. We feel that it is understood what is meant with replacing coal. It is not clear what you mean by % change per year. What has and increased rate?
31172	TS	47				no explanation provided for different usage of fonts (red, green) in table...	Suggested: Taken into account - caption revised
20201	TS	47		47		Fugitive methane capture and use or treatment: there are several CDM projects that use fugitive methane to produce power. These should be mentioned here.	Rejected. There is no space to add examples for all the different measures suggested here.
26183	TS	47				Please replace nuclear replacing coal power with nuclear replacing fossil fuels. Likewise replace BECCS replacing coal power with BECCS replacing fossil fuels.	see ch7 comment 26179
25664	TS	47				In the "Economic" column of "Nuclear replacing coal power" and "RES replacing fossil fuels", the description of Energy security should be revised to "Energy security if fossil fuel power is dominant" because the degree of energy security depends on the constitution of power grid. For example, coal power is necessary to some extent, if coal power is not dominant.	see ch7 comment 25720
25665	TS	47				In the "Economic" column of "Nuclear replacing coal power", the description of Affordability should be deleted completely because the estimated generation cost of nuclear power is generally not higher than that of coal power.	see ch7 comment 25721
25666	TS	47				In the "Social" column of "RES replacing fossil fuels", the description of "Local employment and value added at the place of deployment" should be deleted completely because there is no clear evidence to claim this description and because other kinds of power plants also have same effects.	see ch7 comment 25722
34752	TS	47				On nuclear replacing coal power: In the "Economic" box: added energy security (or reduced import dependency) will materialise only if the country doesn't import its nuclear fuel. Otherwise it's just replacing one imported fuel with another one. The "Social" box is missing: Major risk of conflicts about citing / high levels of public opposition	see ch7 comment 20894

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34753	TS	47				On RES replacing fossil fuels: According to recent studies (by IRENA and others, see above), renewable energy is becoming increasingly competitive with fossil fuels, and in the future the competitiveness is expected to further improve. Therefore "Affordability" in box "Economic" should at least read, in brackets, MAY increase the direct costs of electricity generation (rather than "increases in many cases the cost of electricity generation"). Under box "Social", risk o conflicts related to citing is not unique to renewable projects. It's applies to all energy projects. Neither is "noise" unique to renewables, so it seems misplaced here, and just be part of the siting conflict point.	Taken into account. Affordability issue removed. Local conflict is also mentioned for CCS
34754	TS	47				On fossil CCS replacing coal, under "Economic", why would import dependency be lowered? Coal plant with CCS needs more coal than one without.	Accepted. Removed.
30504	TS	47				In the column of "economic" for nuclear replacing coal power, it states "increases the cost of electricity generation", but this does not apply to all countries.	Accepted.
19143	TS	47		50		This table looks at the mitigation options. The mitigation options in the residential section concentrates on electicity supply to the neglect of biomass and fosil fuel used for cooking. In the Building sub-sector, it talks about switching to 'non-traditional' fuel to increase productive times for women and children. Many families will still be using so called 'traditional fuels' and providing them may be an economic opportunity forr such families. So improving the supply and end-use efficiency of these fuels should be a priority. Regarding industry, (P 49), the informal sector has been excluded. The AFOLU section plays up reduced food security and land-use options etc. With propoer land use planning, especially if the local people have a vested interest in the land, this should be an opportunity rather than a problem	Noted - the tables are merely a summary of the more detailed discussions in the chapters 7-11 and hence provide a summary of mitigation measures on additional objectives/concerns.
22438	TS	47				[RES-Environmental] Add "ecosystem (bird strike)" as a risk for wind.	Taken into account. We note potential wildlife impacts
22439	TS	47				[RES-Environmental] Add "impact on landscape" as a risk for PV.	Rejected. The impact on the landscape of PV is not necessarily larger than that of coal power.
22422	TS	47		47		[Nuclear replacing coal power - Economic] Replacing coal with nuclear power does not always increase the cost of electricity generation, thus this sentence should be deleted.	Accepted.
22423	TS	47		47		[RES - Social(including equity)] Exaggerated use of RES (solar and wind with without battery or other voltage adjustment facility) may result in electricity blackout in the grid because of its unstability. Thus "possibly risk of blackout increase" should be added as a risk of RES.	Rejected. There are many ways to poorly implement a technology and a discussion of such cases is not useful here.
22443	TS	47		47		[RES-Social (including equitey)] Add "PV (mega-solar)" after the risk of conflicts about the siting of plants.	Taken into account. Please note that the point has been deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26008	TS	47				Fugitive methane mitigation, use and costs has been evaluated and can be presented in the table. See sources 1 and 2 below. Several international projects are implementing VAM mitigation. Projects under UNFCCC are documented and numbers on mitigation colume and associated costs are described. See sources 3 and 4 below. Sources: 1) Global anthropogenic methane emissions 2005-2030 Technical mitigation potentials and costs L. Höglund-Isaksson International Institute for Applied Systems Analysis, Laxenburg, Austria Correspondence to: L. H¨oglund-Isaksson (hoglund@iiasa.ac.at) Received: 10 February 2012 – Published in Atmos. Chem. Phys. Discuss.: 3 May 2012 Revised: 4 September 2012 – Accepted: 5 September 201. Published: 4 October 2012 2) Suppl material to iiasa Global anthr CH4 oct 2012 Global anthropogenic methane emissions 2005-2030: Technical mitigation potentials and costs. Detailed descriptions of estimations by sector L. Höglund-Isaksson {International Institute for Applied Systems Analysis, Laxenburg, Austria} 3) UNFCCC VAM projects 4) Jizhong Energy Zhangjiakou-PDD-2012.09	Rejected. Please note that the TS does not have enough space to address examples. Thank you for suggesting references; I wish this was less cryptic so we could more easily identfy the sources.
28890	TS	47		47		"Nuclear replacing coal power". Environmental dimension should also consider environmental risks (large scale accidents, unsolved waste disposal, health risk due to radioactivity leaks). The mining for Uranium is accompanied by significant social and environmental costs. Severe, persistent, widespread damage to health and ecosystems possible in case of radiation leakage or large scale accident. Requires large heat sinks (often Rivers) which can affect local ecosystems. Moreover, large-scale accidents have disastrous economic and environmental effects and should therefore be mentioned in all three categories. Please indicate in red in the column "Environmental".	Accepted. Please note that there are only very limited peer reviewed journal references that could be found to support your suggested claims. The cooling needs of coal and nuclear pp are similar.
28891	TS	47		47		BECCS: The issues for bioenergy/AFOLU apply here too, please add.	Accepted. Please note that this is addressed in Ch.11
28892	TS	47		47		Line "Fossil CCS replacing coal": In the column Economic it says "(but possibly better compared to variable and unpredictable RES)" - why this sudden comparison with RE instead of fossil fuels? This is a diversion from the general methodology for this table, which seems to be a comparison with fossil fuels.	Accepted.
28893	TS	47		47		Line "Fossil CCS replacing coal": Please add in "other" column: Innovation risk (CCS has not yet been applied to a large, commercial fossil fired powerplant) and barriers (public acceptance is low in some countries).	Accepted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28894	TS	47		47		Phasing out fossil fuel subsidies (which are still widely played) should be highlighted as one of the mitigation options in the table. They have a strong influence on costs of electricity e.g. and often influence negatively the economics of climate friendly technology options.	Rejected. This table addresses technological measures not policy instruments
28895	TS	47		47		Poor wording in the column heads. "Non-climate objectives" should rather be "non climate benefits/costs" or "non climate effects".	Suggested: Taken into account - text revised
28896	TS	47		47		RES replacing fossil fuels/economic: language (and red color!) on the affordability should be changed to neutral e.g. "affordability (may reduce or increase cost of electricity generation)". Affordability of and costs for electricity generation depend on e.g. energy markets, local costs of non-renewable energy sources and possible support schemes of RE in place etc. In many places, RE is competitive with fossil fuel supply or even cheaper. In the long term, this is even more evident (rising fossil energy prices and declining RE T prices.)	Accepted. Please note point has been deleted.
28897	TS	47		47		RES replacing coal, Other. The supply of rare earths does not apply to all RES technologies, and can be substituted by alternative technologies (e.g. Wind energy).	Accepted. Language has been changed.
28898	TS	47		47		RES replacing coal, Other. Variable supply of RES, hence the requirement for measures to match supply and demand, is not valid for bio energy and geothermal power.	Accepted. The point is now made more specific wrt technology.
28899	TS	47		47		Table TS.5: The table is not in accordance with table 7.4 (p. 44) in chapter 7. RES/Environmental - Wind: please add impact on wildlife ("Wind: impact on wildlife and landscape")	Accepted - table revised.
28900	TS	47		47		The message ot table TS.5 seems biased concerning nuclear and fossil energy. Risk of conflicts about the siting of plants: erase wind (minor part compared to hydro and quite comparable to possible conflicts in case of fossil power plants).	Rejected. The table is not biased. Please note we have specified the text.
29152	TS	47		49		To avoid any accusations of policy prescription, could it be defined explicitly how the "selected mitigaiton options" were selected.	Suggested: Taken into account - explanation added.
39131	TS	47	5			Comments as for Table 7.4: (1) BECCS should distinguish itself from Fossil CCS, on energy security objectives: Expanded deployment of BECCS could create bioenergy trade dynamics capable of compromising the security of heavily bio-importing regions (color reversal, relative to Fossil CCS entry). (2) Nuclear, fossil CCS, and BECCS are described as "replacing coal"; this incorrectly (a) rules out their quite possible substitution for other fossil fuels, especially in high-mitigation scenarios, and (b) suggests one-to-one interchange on an unidentified (whether energy, capacity, or other) basis. Recommendation to rephrase - e.g., "displacing fossil fuels" - and move descriptor into caption, to tighten table entries.	see ch7 comment 36860

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32278	TS	47		50		Too much aggretation and misleading explanations manywhere because clarifications of the assumptions are absent. Renewables energy must be broke down into intermittant power generation such as PV and wind, and stable souce such as hydro and geo-thermal since the advantages and disadvantages, constraints, costs (including necessity of back-up generation capacity) and public acceptance are very different among them. Industry sector also needs to have a breakdown since the energy consumption patterns, products and the ways of their contributions (both positive and negative) are too diverse to be generalized.	Rejected - due to space constraints this table format was chosen to present as many interactions between mitigation and other objectives as possible based on the available literature for the respective sectors. The table captions make the most important caveats explicit and more detailed information (including clarifications and assumptions) are available from the respective sector chapter sections. Please refer to the Special Report for Renewable Energy Sources and Climate Change Mitigation for a more detailed discussion of individual renewable energy technologies.
29760	TS	47		50		Why the different colors of text in the table??	Suggested: Taken into account - caption revised
34755	TS	48				On fuels switching etc in buildings: Is there evidence supporting the claim that in MOST cases increases the cost of energy for the consumer?	Taken into account - table revised.
25422	TS	48				TS:p.48 Table TS.5: Mitigation options;Transport, Non-climate objectives; Environmental "Health and ecosystem benefits due to (i) reduced urban air pollution and (ii) reduced exposures to air pollution" "Health benefits from shifts to active transport modes" COMMENT (1): "(ii) reduced exposures to air pollution" should be deleted. REASON (2): People shifting from passenger car to walking will be exposed more to air pollution. And, chapter 8, p.46, line31-32, describe "An increasing in walking and cycling activities could therefore lead to health benefits but conversely, may also lead to an increase in traffic accidents and larger lung intake of air pollutant." COMMENT (2): "Health benefits from shifts to active transport modes" should be replace with "Health benefits from shifts to pedestrian or cycles" REASON (2): 'active transport modes' is unclear.	Accepted - entries revised.
28901	TS	48		48		Line "Fuel switching, RES incorporation, green roofs, and other measures reducing CI of buildings sector" column "Social" reads: "Increased productive time for women and children (for switch to non-traditional cooking fuels in residential buildings in DCs)". Disregarding the speculative nature of this statement, it also claims that all cooking and heating in all DC is done by women and children. The same holds true for the next line.	Rejected.
28902	TS	48		48		Line "Journey reduction and avoidance", column "Environmental" reads: "Potential risk of damages to vulnerable ecosystems from shifts to new and shorter routes". This seems highly speculative, the opposite could be true as well.	Rejected - this entry on shipping is based on scientific literature. Presumably, the reviewer was not aware of the maritime transport context - this was clarified in the new draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28903	TS	48		48		The statements on transport are very positive, but it is a fact that most people want their own car (barrier to decrease individual transport) and the car should be fast and big (barrier to avoid journeys or to optimize for climate protection). Such behavioral barriers are addressed in ch 8 and should be mentioned in column "others".	Rejected - this entry on shipping is based on scientific literature. Presumably, the reviewer was not aware of the maritime transport context - this was clarified in the new draft.
29153	TS	48		48		Bottom cell in third column states "Affordability (reduces in most cases the cost of energy for the consumer)" - it's unlikely that energy efficiency reduces the "cost of energy" for the customer, instead it will reduce the amount of enery required and therefore a lower energy bill should result.	Suggeste: Taken into account - text revised
30505	TS	49				It should be mentioned that "SMEs" stands for "Small and medium-sized enterprises".	Editorial
30685	TS	5				1. Suggest adding to top of each panel the descriptors "Total Emission" (left panel) and "Per Capita Emissions (right panel). 2. the acronym REF is used in the graphic whereas EIT is used in the Figure caption. Consistency here would be helpful.	Noted.
23155	TS	5				Figure indicates that OECD has larger territorial than consumption-based emissions. This is backward.	Accepted. The caption is wrong. This has been corrected.
25428	TS	5				Need to reference figure in text.	Accepted.
25429	TS	5				Would be more clear if you explained what you mean by territorial vs. consumption based emmissions in legend, or move figure later in chapter, after it has been introduced by text (pg. 6). "EIT" in figure caption should be "REF"; not consistent between figure and legend.	Noted.
28701	TS	5		5		the time horizons to describe the relative annual GHG trend in %/yr are arbitrary (1970-1980; 1980-1997; 2000-2007, …), , unless not descripted briefly. Time horizons should have the same length.	Accepted. We have changed this to average annual growth rate per decade.
29107	TS	5		5		regions are classed in different ways in these diagram. It would be helpful to maintain consistent country categoristation for comparison.	Rejected. Different types of questions and findings require different classifications.
22383	TS	5		5		The country groupings contained in this Figure TS.1 in which G-20 membership is used as a grouping criterion are not consistent with the traditional country groupings used by IPCC (which are either UNFCCC Annex I (e.g. OECD 1990 countries and Economies in Transition) and non-Annex I (e.g. Asia, Middle East and Africa (MAF or AFM), Latin America (LAM)) countries). Figure TS.1 should be changed in order to reflect the traditional IPCC country categories or groupings rather than create new ones which are not even recognized as such in the UNFCCC regime. Providing for consistent country groupings within and across chapters will also allow for more scientifically rigorous comparability among country groupings. Figure TS.1 should either be deleted or be replaced, instead, by Figure 5.2.1 from Chapter 5, as Figure 5.2.1 is consistent with traditional IPCC practice in relation to country groupings.	Accepted. We have moved towards a commonly accepted definition of economic regions by the Worldbank. However, an economic definition of regions is important for a relevant synthesis of the literature on emission trends and drivers.
39029	TS	5	1			It would be useful to present annual growth rate for 2000-2010 perod to correspond to the discussion in the text.	Accepted.
28692	TS	5	1	5	1	enlarge font of legend	Noted.
28693	TS	5	1	5	1	legend: please put the symbols for the periods of economic recessions in a chronological order	Rejected. We decided to rmove economic recessions from graph.
28694	TS	5	1	5	1	the last change in global GHG emissions of 1,6%/yr. starts 2008, but has no ending. Since the timeline ends at 2010, you might add 2010, or explain, why this period has no ending.	Noted.
28695	TS	5	1	5	1	the time horizons to describe the relative annual GHG trend in %/yr are arbitrary (1970-1980; 1980-1997; 2000-2007, …). Time horizons should have the same length.	Accepted. We move to average annual growth per decade.
28696	TS	5	1	5	1	title of the vertical axis: please add CO2eq in the brackets (Gt CO2eq/yr)	Accepted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39030	TS	5	10			Cross check the legend and the graph as there are inconsistencies. Also, line colors are hard to read, sugest better legend. There is no red-dotted lines in the figure. Suggest a different title to be more explicit what the graphs are showing.	Noted.
39031	TS	5	10			The placement and related discussion of Figure TS.2 is not representative of the placement and discussion of this figure in Chapter 5. This figure is very prominently placed in the TS as the second figure. However, it appears as the 22nd out of 23 figures in Chapter 5 of the full report. Further, important contextual information, such as that found in FAQ5.2 ("Why is it so hard to attribute causation to the factors influencing GHG emissions?") and Box 5.2 ("Definitions of Territorial and Consumptive-based emissions") is not included in the TS. Without this information, the TS implies that consumptive emissions are on equal footing in terms of acceptance and importance within the context of the UNFCCC as are territorial emissions, which is not the case. If this figure is to be included at all in the TS, it needs discussion of the difficulty (and uncertainties) in calculating life-cycle emissions. Further, the relative efficiency of goods produced in one region of the world vs another should also be provided. What quantity of emissions are associated with the production of a good in an OECD90 country, compared with the production of the equivalent good in Asia, combined with the emissions in the packing and shipment of this good to the OECD90 country in question? Without a broader discussion and context, this figure is both misleading and not representative of the chapter it was taken from.	Rejected. The order of figures in the TS does not reflect their relevance. There has been a considerable increase in the literature on consumption-based emissions since AR4. This is a main development in the literature. It is important to reflect this in the summary documents.
39032	TS	5	10			The figures refer to a colored area as REF, but there is no REF in the figure caption. Does REF refer to the same nations as EIT in the figure caption?	Accepted.
39033	TS	5	10			Fig TS.2 is problematic for the following reasons and needs to be revised heavily or replaced altogether: (1) this only shows the import/export of energy CO2, 60% of total GHG emissions; the MATCH database (www.match-info.net) and associated references (such as Hohne et al., Climatic Change, 2011: DOI 10.1007/s10584-010-9930-6) are much better resources as they include CO2, CH4 and N2O from all major sectors for all nations from 1750-2100. Additionally, literature such as Pongratz & Caldeira (Environ. Res. Lett., 2012: doi:10.1088/1748-9326/7/3/034001) illustrate how historic LULUCF emissions are significant and should not be ignored in discussions of historic responsibility, (2) the figure grossly overstates our certainty about these numbers - if proper uncertainty were included, the import & export lines would almost certainly overlap substantially, (3) goods are sold on a global market where they are sold on a supply chain that implicitly assigns a lifecycle value (whether fully accurate or not) to that product, so any cost of carbon could be embedded in that product if the producer chose to include it.	Rejected. Figure TS.2 cannot be based on MATCH. It requires information on territorial and consumption-based emissions. MATCH does not provide that. These are currently available in time series only in terms of CO2 emissions from industrial sources. We have added a sentence on consumption-based emissions to the discussion of uncertainties.
28697	TS	5	10	5	10	Explanation of REF is missing. Take the same explanation as for Figure SPM.2	Noted.
28698	TS	5	10	5	10	Figure TS.2: in the brackets - please use the consistent writing for "per year" by using the "/"	Noted.
31361	TS	5	11			This Figure uses the definition of ASIA which means Asia except from Japan. This should be clarified in the Figure Caption, in order to avoid misunderstandings.	Noted.
30684	TS	5	11	5	11	Territorial emissions should be described by the blue dashed (not solid) lines and consumption emissions by the red solid (not dashed) lines.	Accepted.
28699	TS	5	11	5	11	"territorial emissions": please add an explanation in the Glossary	Noted.
28700	TS	5	11	5	11	Wrong figure description: the blue lines are dotted, not the red ones.	Accepted.
29106	TS	5	11	5	17	key has mutliple errors. Blue lines are infact dotted and red lines are not dotted. Key refers to EIT but REF used in diagram.	Accepted.
31362	TS	5	15	5	15	Does EIT in the figure text correspond to REF in the figure?	Noted.
21413	TS	5		5		Figure caption: (1) blue lines should read blue dotted lines, red dotted lines should read red lines; (2) the figure shows "REF" but the caption mentions "EIT".	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20028	TS	5	10	6	16	Consider replacing "Figure TS.2" with the two bottom panels of "Figure 1.4" of chapter 1 (p.20 line 2-11) to be more consistent with the main text.	Noted.
26290	TS	5	9	5	11	The graph´s explanation changes the colors. Lines are red in the graph and dotted lines are blue. The explanation has blue lines and red dotted lines.	Accepted.
31384	TS	50		50		Row 2 (increase existing carbon pools), column 5 (environmental effects): afforestation/reforestation can also lead to habiatat loss and associated loss of biodiversity. For albedo: is the results on albedo always positive regardless of tree type and region of the world?	Accepted. Table has been revised
31385	TS	50		50		Row 3 (substitution), columns 4 (social effects) and 5 (environmental effects): move "can promote forest conversion→bidoiversity loss" from column 4 to column 5 or add "habitat loss to to forest conversion→biodiversity loss" in column 5.	Accepted. Table has been revised
30506	TS	50				Not only scenarios of category 1 but also other scenarios should be presented here.	Suggested: Rejected: The broad range of the scenarios is shown elsewhere in the TS.
28905	TS	50				Footnote 1: Where is this footnote used? And what is a "stylized immediate action policy assumption"? (P1?)	Suggested: Taken into account - footnote revised
28904	TS	50		50		Delete "avoided" in context of deforestation and insert "reduced". REDD+ for instance is about reduced deforestation, but the table uses both terms. "avoided" should be simply deleted.	Accepted. Table has been revised
29154	TS	50		50		Increasing existing carbon pools on cropland has beneficial impacts for food production by reducing soil strength (improving root penetration and water access) and enhancing structural integrity, water and nutrient holding capacity of soils (in the UK many arable soils are depleted of organic carbon [SOC]<2%). Although difficult to quantify there is likely to be a positive yield response from such changes. Long terms data from experiments at Rothamsted (Broadbalk) highlight the crop yield benefits of organic carbon additions to arable soils.	Accepted. Table has been revised
29156	TS	51				This diagram would benefit from a greater explanation and an improved link to the text.	Taken into account - figures deleted.
39132	TS	51	15			Table TS.24 is simply not correct and should be excluded from the summary. For example, uncertainty in climate systems will have an effect outside of just international cooperation and decision making at the state level. Such uncertainty will directly effect decision making at the local government level and the firm level when making adaptation investments. On the other end risks to health will effect decisions at the national and international level as well. There are plenty of other examples that could be presented in between as to why this figure does not capture the reality of the situation.	Taken into account - figures deleted.
28906	TS	51	15	51	18	Figure in its current form is not helpful in understanding the contents of the chapter. It is rather unclear on what statements this figure is based on. What technological uncertainty means is not explained. Risk and uncertainty issues are mixed in an inappropriate way. Why does international cooperation not affect resource allocation and investment (carbon market, climate finance under UNFCCC)?	Taken into account - figures deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39133	TS	51	19	53	10	Regarding human decision-making, the discussion focuses on a few specific techniques or is at a very abstract level, and not very prescriptive. The authors should consider adding a few sentences along these lines: In the residential and small and medium business sectors, most energy saving actions involves behavior: purchasing and installing technology such as an more energy efficient refrigerator; settings and control behaviors such as lowering thermostat temperature and reducing pool pump use; maintenance behaviors such as cleaning furnace filters; changing habits or repeated behaviors such as hang drying clothes and bicycling rather than using a clothes dryer and driving; eliminating wasteful energy uses such as extra refrigerators and DVRs; etc. These actions can be facilitated through the application of behavioral principles through programs implemented at the policy/incentive, technology, built environment, media/marketing, and organizational/community levels. It is important to evaluate these programs in order to assess their energy savings, and improve programs over time. In addition, the ability to quantify energy consumption via the smart grid has the potential to allow for personal energy consumption feedback at scale, as well as objective evaluation of energy consumption.	Taken into account - covered in section 3.2.
39134	TS	51	19	53	10	This section that discusses human decision-making is out of place. It doesn't fit into the rest of TS.5 on institutional options by governance level nor lead to further discussion on how the human decision-making can be addressed by policy to enhance mitigation response to climate change in the context of institutional options. The authors should re-evaluate the usefulness of this section and consider to condense and place it where behavioral issues are discussed. The following topics from chapter 2 should be moved forward to TS and SPM instead of the current text: decisionmaking under uncertainty and how decisions can be made under these conditions and which tools to use to analyze them.	Accepted - text revised.
28907	TS	51	19	51	33	The para talks about risk perception. In line 6 "uncertainty" is abruptly introduced and further recommendation focuses on uncertainty. This is not coherent. It should be explained, why the shift is made. See also comment on SPM 5.1	Accepted - text revised.
39135	TS	51	20	51	22	"The success of climate policy depends on how people perceive and respond to climate and other risks in their choice context" is too strong an assertion in some sense and incorrect in others. A policy like a carbon price that provides the proper incentives to consumers may not reach an expected goal due to unforecast behavioral responses but that doesn't mean it won't be successul. If the statement is asserting that public support for climate change policies is influenced by there level of information which may currently be incomplete it should be made more specific.	Taken into account - covered in section 1.
29155	TS	51	30	51	30	Our research shows that personal experience does alter perception of climate risks. However, the term distort implies a disadvantageous shift in risk perception. Is it not as likely that the altered risk perception as a result of personal experience provides a more realistic perception of risk?	Taken into account - covered in section 1.
25035	TS	52	12	52	20	Suggest that the focus on resistance to change would benefit from more optimism. Where decision makers see benefit (often intangible) or opportunity to benefit, their response to change is quite different from resistance - they often embrace it enthusiastically.	Noted - text revised.
25036	TS	52	29	52	46	Suggest describing both positive and negative feedback effects as 'flow-on' effects, which can be positive or negative due to policy measures, spending preferences and dominance of other factors beyond energy use in decision-making.	Accepted - text revised.
22905	TS	52	29	52	46	which chatper is this para from ?	Accepted - text revised.
40934	TS	52	29	52	46	Please indicate from which chapter does this paragraph come.	Accepted - text revised.
29157	TS	52	38	52	40	The use of 'them' is not well qualified here.	Accepted - text revised.
28908	TS	52	6	52	9	The sentence "There are a variety…" is not to be understood. Some words missing?	Accepted - text revised.
32279	TS	52		52		Discussion must be included on no-regret policies.	Accepted - text revised.
32280	TS	52	29	52	46	Rebound could be more significant if energy price is high as the results of the CC policies.	Taken into account - covered in Box TS.12.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30721	TS	53	12	53	14	Add "long-lived" before "GHG emissions" (line 12) and before GHGs mix globally (line 14).	Accepted - text revised.
39136	TS	53	13	53	14	This assertion that "the atmosphere is overused as a disposal space for GHGs" is a subjective statement. The authors should delete or rephrase the comment.	Accepted - text revised.
28909	TS	53	16	53	16	In contrast to the text in chapter 13 page 9, the text here says "can be excluded", while in chapter 13 the text says "it is difficult to exclude". Please be consistent	Accepted - text revised.
39137	TS	53	18	53	18	What is meant by "those who compromise" in this context? Those who compromise mitigation participation? Please clarify.	Accepted - text revised.
21489	TS	53	20	53	29	the paragraph lacks clarity	Accepted - text revised.
39138	TS	53	20	53	20	The authors should revise the bold statement to read: "Effective adaptation can be promoted through international cooperation." It's not just funding that are incentives, it's technology, research, information, etc.	Taken into account - text revised.
39139	TS	53	22	53	22	One could very easily argue that the benefits of mitigation action are just as much local as they are global given the co-benefits to air pollution, public health, agriculture that very often come with mitigation measures.	Accepted - text revised.
39140	TS	53	22	53	24	This is too narrow a characterization of the benefits of adaptation, which are often not just local. Also, the text in line 23 iis normative framing and not appropriate.	Taken into account - text revised.
39141	TS	53	24	53	26	One could easily argue against this assertion because adaptation investments could increase national security and decrease the costs of humanitarian relief. Additionally, adaptation investments could protect foreign business interests (i.e., supply chains, etc.). As stated, the sentence is inaccurate and needs to be revised if not deleted entirely.	Taken into account - text revised.
33624	TS	53	30	53	30	replace the word 'options' with 'actions', because options are plans waiting to be used, not actual implemented actions.	Taken into account - text revised.
22906	TS	53	30	53	42	geoengineering (more specifically SRM) needs more text in TS	Accepted - text revised.
28910	TS	53	30	53	42	In this para, CDR is not mentioned and it seems as if SRM would be the only technique under discussion. This is strongly misleading and should be corrected. It would also be good, if in the AR5 only one expression would be used (geo-engineering OR climate engineering). The IPCC expert meeting in Peru has decided for geo-engineering.	Accepted - text revised.
28911	TS	53	30	53	42	Please add, if not deleted: "Scientific evidence of the benefits and the possible disadvantages of CDR and SRM are not sufficiently analyzed yet. Furthermore most of the required techniques aren't available yet."	Taken into account - text revised.
28912	TS	53	30	53	42	Please delete this paragraph: it is a one-sided focus on one technology. What about cooperations in RE?	Accepted - text revised.
29158	TS	53	30	53	42	This is the first reference to geo-engineering and it falls under international and regional cooperation. Is geoengineering brought out more widely in AR5 and will this statement link with discussion elsewhere if present?	Noted - text revised.
33625	TS	53	31	53	33	Replace this sentence with: 'Some studies have shown that Solar Radiation Management (SRM) strategies imply, as climate change impacts, that some regions benefit while others may be negatively impacted'.This will be easier to understand.	Noted - text revised.
33626	TS	53	33	53	33	Suggest to change wording to "if a group of countries decided deploying SRM"	Taken into account - text revised.
39143	TS	53	33	53	34	The sentence that begins on line 33, "But, if as a consequence..." is not clear.	Taken into account - text revised.
39142	TS	53	33	53	35	If SRM is done as described here, it would yield global cooling, but there could be other unknown impacts - both regionally and globally. The text needs to be clarified to better relay what is meant by "excludable" in this context.	Accepted - text revised.
28913	TS	53	37	53	37	Discussion and studies on Geo-Engineering also point out possible international conflicts arising from unbalanced costs and unilateral actions. Please add "[….might produce significant costs for others.] This could give rise to international conflicts."	Noted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33627	TS	53	40	53	42	Consider adding a reason to this important statement, e.g. "This is needed to prevent the highly persistent greenhouse warming to build up, which would result in rapid warming when RSM is not indefinitely/continuously increased." Suggested reference: Lenstra, van Doorn, Verheggen, Sahan and Boersma, Chapter 6 "Between emission reduction and adaptation" in "State of the art mitigation and relation mitigation/adaptation" ECN report, Jan 2009, ECN-E--09-014 (available via http://www.ecn.nl/publicaties/ECN-E--09-014)	Taken into account - text revised.
40936	TS	54				Plurilateral initiatives such as Major Economies Forum on Energy and Climate (MEF), Clean Energy Ministers Meeting (CEM) and bilateral ones (e.g., Joint Crediting Mechanism / Bilateral Offset Credit Mechanism) should be incorporated in the Figure SPM 14 from the neutrality viewpoint. (describing only ETS system lacks balance). Unless otherwise, this Figure should be deleted.	Taken into account - other modes of cooperation have been added, but not all those suggested as these are only meant as examples.
40937	TS	54				This figure TS.24 is presumably based on AR4 (2007) after which many developments in findings have been made. Therefore the overly simplified figure does not adequately exhibit approaches to international cooperation and should be omitted.	Noted - figure has been revised.
28914	TS	54	13	54	14	Please use the same title as in the underlying report, figure in chapter 13 (Figure 13.2, chapter 13, page 25).	Taken into account - text revised.
40935	TS	54	16	54	20	It is important to utilize more advanced technology for developing countries to avoid lock-in technologies with low efficiency. So , please maintain this paragraph.	Noted.
26142	TS	54	21	55	2	Proposal: please delete the sentence "While mutually destructive conflicts between the two systems have thus far been largely avoided, pre-emptive cooperation could protect against such developments in the future" because it is negative and does not add anything new to the text. In addition, please remove the word "such" in the next sentence in order to maintain consistency.	Accepted - text revised.
26143	TS	54	21	55	2	We suggest that the following sentences are added to the end of the paragraph to highlight the possibilities of trade liberalization: " Therefore wind should be put in the sails of liberalization of trade in environmental goods and services. Rapid diffusion of clean technologies will be key to climate change mitigation. Unprecedented diffusion of technology needs to take place, and for that all avenues will be needed. The most efficient mover of goods and technologies around the globe is trade.	Taken into account - text revised.
32281	TS	54	1	54	12	Not only descriptions of various types of international agreements but also their strengths and weekness should be discussed	Accepted - text revised.
39148	TS	55		55		The authors could add some more points in this section from Chapter 16, specifically those related to the current barriers to scaling up climate finance, the importance of enabling environments, and the different instruments that can be used to unlock larger scale financing.	Accepted - text revised.
39145	TS	55	10	55	10	Is "raised" the right term to use in the context of both public and private climate finance flows. Perhaps "channelled"?	Taken into account - text revised.
27324	TS	55	11	55	15	We question the level of evidence, as in the case of Brazil the carbon market through the mechanisms of the Convention (CDM of the Kyoto Protocol) values are much higher than the flows of international cooperation (according to the Second National Communication of Brazil, the CDM 2009 represent the 16th item of the export worth around USD 750 million in market value).	Noted - text revised.
39146	TS	55	11	55	15	It is confusing to simply say that "climate finance reported under the UNFCCC accounts for less than 3% of current climate finance." It's unclear here what is meant by "reported under the UNFCCC". Do you mean climate finance that has been reported as part of UNFCCC National Communications? If so, the authors need to specify that. A more accurate phrasing might be: "Climate finance reported as part of the formal reporting requirements of the UNFCCC accounts for a very small percentage of all current climate finance flows." Also, the text needs to be clear that reporting requirements under the UNFCCC have improved in recent years, so better data should be available for more recent years, especially now that the common reporting format for the Biennial Reports has been developed.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39147	TS	55	11	55	15	The fast start finance statistic - $28 billion - should be updated based on official information presented at the Doha climate conference. Donor contributions to fast start finance exceeded $33 billion, and this was the basis of the COP decision acknowledging the fulfillment of the fast start finance commitment.	Accepted - text revised.
28916	TS	55	11		13	Make two sentences out of one: Climate finance reported under the UNFCCC accounts for less than 3% of current climate finance. About 15-25% of the public international climate finance flows to developing countries (medium evidence, medium agreement).	Accepted - text revised.
28931	TS	55	11	55	13	Make two sentences out of one: Climate finance reported under the UNFCCC accounts for less than 3% of current climate finance. About 15-25% of the public international climate finance flows to developing countries (medium evidence, medium agreement).	Accepted - text revised.
28917	TS	55	11	55	15	There should be additional information to support a better interpretation of these numbers (e.g. examples to illustrate which climate finance is reported under UNFCCC and which is not.)	Accepted - text revised.
22392	TS	55	11	55	15	There should be a reference in this paragraph to Article 4(3) of the UNFCCC with respect to the provision of climate finance as a treaty commitment on the part of Annex II countries.	Taken into account - text revised.
20202	TS	55	13	55	14	same comment as for same figure 14 in SPM on page 24.	Noted - text revised.
28918	TS	55	13	55	13	In contrast to carbon taxation, ETS-systems require clarification on the goal, i.e. the amount of certificates to be created for a time period. Thus it should be much more on the "end" side of the graph than carbon taxes.	Taken into account - text revised.
29159	TS	55	13	55	15	The figures quoted are not directly comparable.	Taken into account - text revised.
28919	TS	55	14			The Fast Start Commitment is 30 billion USD. It is a political commitment and not a technical value being the result of extensive economic calculations. Therefore, a price-adjustment is not appropriate. Moreover, in other parts of text (e.g. ch. 16, p. 12, line 31), the commitment of 30 billion USD is mentioned - without price adjustment. (See comment to ch. 16, p. 4, line 14 and to SPM, p. 24, line 14). See also description of "Copenhagen Accord" in Annex I.	Accepted - text revised.
28920	TS	55	14			update the number of Fast Start Finance on the final reports of developed countries on Fast Start Finance in May 2013	Accepted - text revised.
31386	TS	55	28	55	28	Very informative finding	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22393	TS	55	29	55	41	The text here provides an uncritical acceptance of the concept of emissions trading and carbon market mechanisms in general. However, both the concept and practice of emissions trading has been critiqued substantively. There should also be text that indicates that there are critiques to emissions trading. Such text could be as follows: "However, it should be noted that both the theory and practice of emissions trading and carbon markets as applied to mitigation have also been viewed critically and with caution both academically and, in the context of the UNFCCC negotiations, politically." For published academic critiques, see, e.g., Larry Lohmann, Carbon Trading, Climate Justice and the Production of Ignorance: Ten examples, Development (2008) 51, pp. 359–365; Michael Hopkin, Emissions trading: The carbon game, Nature 432, 268-270 (18 November 2004); Heather Lovell et al., Carbon Offsetting: Sustaining Consumption?, Environment and Planning A 2009, volume 41, pages 2357-2379, at http://sciencepolicy.colorado.edu/students/envs_4100/lovell_2009.pdf; Steffen Bohm and Siddhartha Dabhi (eds), Upsetting the Offset: The Political Economy of Carbon Markets (MayFlyBooks, 2009), at http://www.libros.metabiblioteca.org/bitstream/001/314/8/978-1-906948-07-8.pdf. For political critiques in the context of the UNFCCC negotiations, see, e.g. Bolivia, at http://unfccc.int/files/bodies/awg-lca/application/pdf/20120518_bolivia_nmm_2100.pdf and at http://unfccc.int/resource/docs/2012/awglca15/eng/misc06a02.pdf; and Philippines on behalf of a group of like-minded developing countries, stating that "Another important lesson to take stock of is the current collapse of the carbon markets. In this light, the effectiveness, viability and environmental integrity of market mechanisms for mitigation need to be reviewed and considered with caution, especially proposals for their expansion", at page 8 of their submission (http://unfccc.int/files/documentation/submissions_from_parties/adp/application/pdf/adp_lmdc_workstream_1_201 30313.pdf).	Taken into account - text revised.
28921	TS	55	33	55	34	Positive assessment of KP/CDM here is not consistent with negative assessment of KP/CDM in ch. 4, p. 33, lines 18-25.	Taken into account - text revised.
40938	TS	55	35	55	39	2/3 of CDM mitigation is from China, and scarcely from Africa. Please analyze the reasons for the localization and discuss in Chapt.13.	Taken into account - text revised.
28922	TS	55	37	55	38	Assessment of MEF, G20 should take into account their mandate (with respect to G20: see comment concerning ch. 13, p. 69, lines 6-7.)	Taken into account - text revised.
39144	TS	55	6	55	6	Instead of saying "Availability of carbon funds," the authors should revise the text to read: "Availability of climate finance".	Taken into account - text revised.
30722	TS	55	9	55	9	Presume 120-41 billion should read 120-141 billion.	Accepted - text revised.
32216	TS	55	9	55	9	120-41, there is an error	Accepted - text revised.
28915	TS	55	9	55	9	Please check "USD 120-41 billion". Does this mean 120-141 billion?	Accepted - text revised.
32282	TS	55	22	55	28	Ability of adapatation is considered to increase together with economic depelopments.	Taken into account - text revised.
25668	TS	56				In the "Aggregate Economic Performance" column of "Further Agreements under UNFCCC", this part should include "Various approaches that is not based on market mechanism" because they might also improve cost efficiency.	Taken into account - text revised.
34756	TS	56				I disagree with the claim that the commitments under Kyoto Protocol would be progressive. What is the criteria used to define them progressive?	Taken into account - text revised.
34757	TS	56				is there evidence supporting the claim that removing fuel subsidies would have negative effects on oil-exporting countries? It is not clear where in the undelying chapter there would be evidence for this claim. According to the IEA estimates, six of the world's ten largest energy subsidizers in 2010 were found in the Arab world, namely Saudi Arabia, Egypt, UAE, Iraq, Algeria and Kuwait. In many cases, the share of government expenditure on fuel subsidies exceeds social spending on pro-poor sectors such as health and education. Surely removing fossil fuel subsidies could come with benefits also for oil exporting countries.	Taken into account - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27286	TS	56		56		Reference to "major emitters" is not scientically sound and is not politically acceptable.	Accepted - text revised.
27287	TS	56		56		Reference to the institutional feasibility of the Montreal Protocol must include: "cover only greenhouse gases that deplete the ozone layer".	Taken into account - text revised.
29161	TS	56				Additional information on the operational mechansism, enforcement etc for each policy would be beneficial.	Accepted - text revised.
31291	TS	56	18	56	19	"EU emission trading system has been successful as an instrument" : this sentence needs to be justified by empirical evidence	Accepted - text revised.
25667	TS	56	18	57	2	This part should be kept in the final version report because market-based mechanism such as emission trading has several problems. Volatility of emission permit prices affects volatility of product prices as evidenced by fluctuating price developments in the EU-ETS. Therefore, the market-based policy tools of cap-and-trade cannot provide credible incentives for the technological change, as described in (Montgomery, 2005, abstract) and (Baldursson, 2009, page29). In addition, CO2 leakage caused by the implementation of the ETS happened actually through transfer of industry from one country to others. Market mechanisms at least under Kyoto-like international scheme, where the condition of all countries' meaningful participation is not met, do not work well, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No9 line of this table.	Noted - text revised.
34758	TS	56	18	56	20	The claim that the EU's emission trading system would have been successful seems odd, in light of the real world situation today, where the market has collapsed into irrelevance, due to a massive amount of surpluss allowances in the system, and it is not preventing European utilities from switching from gas to coal. Consequently, more honest evaluation should take place in the underlying chapters.	Accepted - text revised.
27288	TS	56	18	56	19	Reference to the EU Emissions Trading System as a "successful instrument" may be taken as a political judgment, and should, therefore, not be included in the IPCC Technical Summary. Recent events may also question this judment.	Accepted - text revised.
40939	TS	56	18	56	19	Please explain the meaning of "the EU Emissions Trading system has been successful as an instrument" more clearly.	Accepted - text revised.
29160	TS	56	18	57	2	Some explanation/discussion around the problems experienced int hese schemes would be valuable. Especially for 'unanticipated interactions between policies'.	Accepted - text revised.
20203	TS	56	33	56	34	I like that line because it highlights the CDM's contribution without "however".	Noted - text revised.
29761	TS	56		56		Kyoto Mechanisms: add a timeframe to the 1.15 billion CERs and 0.6 billion JI credits	Taken into account - text revised.
20204	TS	57		57		Please delete "additionality under the CDM remains an issue". The EB and its expert panels as well as the high level policy dialogue have looked at the issue multiple times and clearly come to the conclusion that there is a lot of suspicion and assumptions and different interpretations of additionality but that none of the registered projects is proven to be non-additional. Also, please delete "some" evidence of technology transfer in the third column. There is indeed very very much evidence of technology transfer: from A1 to non-A1, from non-A1 to non-A1, from city to countryside etc. Or in other words: there is no alternative that has provided more technology transfer than the CDM, by far.	Taken into account - text revised.
25669	TS	57				In this figure, Tokyo is described as Sub-National ETS. But this description should be deleted completely because Tokyo CO2 Emission Reduction Program is currently under the special measure for the Great East Japan Earthquake, which allows CO2 emission increase caused by home generation. This means that the program is not implemented under normal condition. Therefore, Tokyo CO2 Emission Reduction Program should not be considered as a good example of carbon markets. In addition, many countries are described as Japanese bilateral mechanism projects in the same figure. But Japanese bilateral mechanism should be deleted completely because the mechanism is different from Cap and Trade schemes. The mechanism is not based on CO2 emissions limitation on Japan.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21491	TS	57	13	57	22	The discussion on which instrument creates most certainty seems to be unbalanced. Taxes can create similar uncertainty or uncertainty in the short and long term as feed-in tariffs. The latter also have regulatory risks, as demonstrated by retroactive changes that have occurred in some systems. Feed-in tariffs are limited to specific technology options and do not give incentives for a broad set of options and reduction strategies as carbon pricing does. Carbon pricing through emission trading has benefits in relation to environmental outcome/risk, and can create certainty about long-term ambition level. For instance, a feed-in tariff for a low-carbon technology might promote this technology in the short term but does nothing to disincentivise investments in carbon-intensive technologies (e.g. would a feed-in tariff for, let's say, wind really discourage investments in coal?). Emission trading can also set higher marginal incentives in the form of carbon pricing while still limiting direct costs for those affected through free allocation. Furthermore different instruments have costs for different actors, i.e. who pays any bill and have certain instruments not hidden costs and risks in the form of focus on specific technologies? As such this text is not balanced and should be reworded or deleted.	Rejected - FITs create contractual obligations which are perceived to be less prone to changes than taxes.
39149	TS	57	13	57	22	The description of policy mechanisms overlooks a key policy mechanism, direct regulation for the purposes of preserving the national commons. For example, U.S. EPA is evaluating the use of GHG emissions performance standards as a way to directly regulate GHG emissions; as required by the U.S. Supreme Court. This is not a price signal, barrier removal, or promotion of long-term investments. It is a mandate for the purposes of protecting public health. Include this policy type in the discussion, and in Table TS. 7	Accepted - text revised.
31292	TS	57	2			The primary crossreference for this is 15.5.3. Crossref 14.4 should be replaced by 14.3.2.1	Accepted - text revised.
30162	TS	57	21			Change the word "undone" to "diminished." Undone implies rebound effects greater than 100% for which there is limited evidence.	Accepted - text revised.
40941	TS	57	23	57	25	This sentence show the importance of market institution and security of property rights. Maintain this part.	Noted.
22394	TS	57	23	57	25	The assertion in this sentence does not seem to be supported by the literature discussed in Chapter 15. In the reference sections indicated for this paragraph (Chap 15, Sections 15.5, 15.6, and 15.8), the references to "property rights" were with respect to intellectual property rights and land property rights, but the discussion in these sections with respect to these types of property rights does not necessarily support the assertion in this sentence.	Accepted - text revised.
24158	TS	57	4	57	12	This paragragh is NOT technical issue but political one. So, please delete here and move it into SPM.	Taken into account - text revised.
22907	TS	57	4	57	12	KEEP this para as it is important finding for policy makers. Move this para to SPM.	Taken into account - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21490	TS	57	4	57	12	The paragraph needs some rewording. The emboldened part of the paragraph seems correct only if your only objective is limiting GHG emissions. But often policies are not only developed because of climate concerns. For instance, in the EU the GHG and renewables target were put in place to meet multiple objectives. If one was only concerned with GHG reductions, it might have been cost optimal to be less ambitious on renewables. This was recognised at the time when the proposal was made and later confirmed in literature (Bohringer et al (2012) e.g.(cited in Chapter 6) makes clear that all additional targets in the EU (renewables and energy efficiency) make the costs of meeting the EU GHG reductions higher than needed. See: Böhringer C. et al. (2009). THE EU 20/20/2020 targets: An overview of the 37 EMF22 assessment. Energy Economics 31, S268–S273. (DOI: 16/j.eneco.2009.10.010). Other sources are: Bergh et al. (2012): Impact of renewables deployment on the CO2 price and the CO2 emissions in the European electricity sector, Series/Report no.: EUI RSCAS; 2012/66; Climate Policy Research Unit, ISSN: 1028-3625, http://cadmus.eui.eu/handle/1814/24680.). But policies that only have higher GHG reductions as an objective (as the UK tax seems to have) do not seem to be effective in the larger context of the EU ETS. The text is not clear in differentiating all these elements. If policies with objectives other than reducing GHG emissions do indeed impact emissions a lot, it could be conceived if this merits further tightening the cap.	Taken into account - text revised.
22842	TS	57	4		15	This paragraph is interesting, some more of this would be needed, but concrete numbers and explicit conclusions are missing. For shaping the policies for the next years more analysis of this kind in greater depth is required.	Noted - text revised.
25055	TS	57	4	57	12	Keep this paragraph and copy-and-paste this onto SPM.	Taken into account - text revised.
40940	TS	57	4	57	12	This paragraph is important for policy makers. therefore, please cite this also in SPM for the purpose of maintaining neutrality (current SPM is structured too much in favor of EU-ETS).	Accepted - text revised.
29162	TS	57	4	57	12	The paragraph is about all tradable permit policies in principle and in theory. Without explictly stating the case for this criticism of the EU ETS it may be wiser politically to use "tradeable carbon permits" instead of "EU ETS", using the EU ETS as just one example of this.	Accepted - text revised.
25037	TS	57	4	57	12	While this section is correct in identifying short-term non-additionality of overlap between ETS and other abatement in covered sectors, there can be long-term environmental benefits. Suggest inserting on line 10: "However, where there is market uncertainty of the long-term carbon price and emissions caps, other mitigation policies can accelerate technological innovation, support a smooth transition to low emissions infrastructure, and avoid the need for abrupt turnover of capital stock at higher costs in the case of more ambitious emissions targets to meet long-term stabilization goals." - or similar	Taken into account - text revised.
35215	TS	57	1	57	3	Taiwan is part of China, not a sovereign state. Moreover, there is no description in the relevant paragraph, thus the description of Taiwan in the figure should be deleted.	Taken into account - text revised.
23031	TS	57	2	57	3	The figure clearly indicates the imbalance of CDN projects distribution worldwide. In Africa, many have only been submmited and accepted but funding is yet to be availed.The processof releasing funding therefore need to be simple and fasttracked if the African region is to benefit from the CDM arrangement.	Noted - text revised.
20205	TS	58		58		also include the WCI http://www.wci-inc.org	Rejected - comment unclear
22843	TS	58		59		The whole analysis of renewable supporting scheme is very weak. There is much more on this that could be said perhaps some results from the SRREN could be included here.	Taken into account - covered in section 3.2.
21492	TS	58	23	58	24	Table TS.7 gives the misleading impression that economic instruments/providing a price signal would not contribute to promoting long-term investments. On what evidence is this based? Economic theory would suggest otherwise. Recommend that this is deleted for the same reason provided in our comment on the last paragraph on p.24	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32603	TS	58	25	59	15	See my comment on the parallel text in the SPM. The TS may be the place to present a more integrated view as indicated, using the Rebound para as an example of the central importance of synergies across the three main pillars of policy responses. Efficiency without pricing ultimately is eroded by rebound. Pricing without efficiency is ultimately impossible because of the impact on bills. For elaboration of such synergies see Grubb et al (2013) Planetary Economics, concluding chapter 12.	Taken into account - text revised.
25670	TS	58	25	58	30	This part should explain that "voluntary agreement" is an effective method to improve energy efficiency and reduce GHG emissions, as described in the section 15.5.7.4. There are successful examples of "voluntary target scheme" in the world. Each industry in Japan has voluntary target and the voluntary target scheme has played a big role, as described in (Yamaguchi, 2012, page35 and 154), (Manuel, 2010, page 6 and 13), and (Yamaguchi, 2010, abstract). In addition, there is also a successful example of "voluntary target scheme" in Netherlands, as shown in (Martijin, 2002, page162). These literatures are listed in the No22 line of this table.	Taken into account - text revised.
40943	TS	58	25	58	30	The description about hidden cost is important… please maintain it.	Noted.
40942	TS	58	3	58	12	Important view point and the matter of behavior change for mitigation action should be researched more in the future.	Noted.
28923	TS	58	31	59	3	Lack of property rights are only one reason for sub-optimal private investments. (They are relevant when it comes to international technology transfer). Another important reason for sub-optimal investments is that "non-climate investments" (e. g. traditional technologies, real estate) promise higher returns - at lower risks. To stimulate private climate-investments the stability of policy framework(policy instruments) is essential to stabilize expectations (and thus reduce risks). Moreover "climate knowledge" in the private investment-sector should be improved to stabilize expectations / reduce risks and thus stimulate private investments.(cp. chapter 16, p.5, lines 16-24). Please add these important aspects.	Accepted - text revised.
22395	TS	58	31	59	3	This entire paragraph should be deleted. Evidence on the impact of IP on promoting technology transfer or investments in non-fossil fuel production is inconclusive to say the least. There are no comprehensive studies to show a general positive relationship. For instance, is there any evidence that IP has promoted technology transfer to African or Latin American countries which are TRIPS compliant or even to those that provide TRIPS-plus protection? It has been shown that 'South Africa has attracted far less FDI than other countries whose IPR system appears to offer potential foreign investors weaker protection' (Kaplan D 'Intellectual Property Rights and Innovation in South Africa: A Framework' in The Economics of Intellectual Property in South Africa WIPO, 2009, p. 4). The study by Mansfield quoted to substantiate the argument of a positive effect of IP on FDI is methodologically weak (based on interviews), outdated (it was conducted almost 20 years ago before TRIPS entered into force); it provides an insufficient basis for the conclusion reached in this section regarding FDI. It is also incorrect to generalize the limited findings of the bibliography quoted in the text. The positive impact of IP on exports, as found by Smith (1999) should not be mixed up with potential effects on technology transfer and FDI. That impact precisely shows that IP owners often opt for the exploitation of foreign markets through sales rather than FDI or technology transfer.	Taken into account - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20198	TS	58	33	59	2	It is wrong to assume that there is market failure for innovation in all sectors. There is no evidence indicating that there is investment 'lower than socially optimal' (what is socially optimal has not been determined anyway) for low-carbon and energy efficient technologies. If this were the case, it would just indicate that the patent system -now in force in most countries of the worldd under the TRIPS/WTO disciplines- does not provide the required incentives to develop new technologies. In fact, patents are neither the only nor necessarily the main instrument to promote innovation in the area of climate change related technologies. Innovation is promoted in a competitive environment: 'Competition can stimulate innovation. Competition among firms can spur the invention of new or better products or more efficient processes. Firms may race to be the first to market an innovative technology. Companies may invent lowercost manufacturing processes, thereby increasing their profits and enhancing their ability to compete. Competition can prompt firms to identify consumers' unmet needs and develop new products or services to satisfy them' (US Federal Trade Commission, To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy. A Report by the Federal Trade Commission, October 2003, Executive Summary, p. 1).	Noted - there is a market failure for innovation as soon as the fruits of R&D are inadequately protected. This is the case if knowledge has a public good character or if there are simple spillovers from knowledge and technology and the patent and or other systems of protection of intellectual property are not sufficiently strong.
28926	TS	59	16	59	24	Please add also a classification of lifecycle CO2 emissions from the different power technologies as a base for calling nuclear a low carbon technology (coal, gas, nuclear, wind, solar and other RE)	Taken into account - covered in section 3.2.
28927	TS	59	17	59	18	Please change to "... the perceived or real risks to health and welfare that they may create"	Taken into account - text revised.
28928	TS	59	18	59	24	The sentence on the risks of nuclear power "Nuclear power is the most visible example of a low-carbon technology that has engendered high levels of public opposition in proportion to demonstrated risk levels, but wind turbines, high-voltage power lines, and carbon dioxide transport and storage facilities have all elicited similar reactions, with substantial effects on the pace of investment." should be justified or removed. The risks of nuclear power are much higher than those of REs, or CCS. It is not correct to that it "engendered high levels of public opposition in proportion to demonstrated risk levels" given the well demonstrated risks that Fukushima showed.	Taken into account - text revised.
25440	TS	59	20	59	21	Consider adding "hydroelectric dams" to this list of technologies that have met resistance.	Noted - text revised.
30724	TS	59	25	59	38	1. This section of the TS is about national and subnational policies, therefore it seems inappropriate to make reference to IPCC reports here. The focus should be on policies, not IPCC reports. Therefore, at a minimum, suggest deleting the first part of this first sentence. 2. In general, this paragraph does not seem to fit in this section and would be better under Section 5.1 on Human Decision-Making, as it is about individual decision-making.	Accepted - text revised.
28929	TS	59	25	59	38	The message of that paragraph is not clear. Do you cite any scientists in that para? If so, please indicate the amount of confidence or evidence in that para. The topic "behavior change" should be moved to the SPM. There you should explain how the behavior change can influence positively mitigation pathways and what are the barriers for a changing behavior in society.	Accepted - text revised.
28930	TS	59	25	59	38	This para is very could be very interesting (governments are the audience of IPCC, but not the only one, and members of government are individuals too), but it differs in style from the rest of the report and should be reformulated in a more factual manner. Please remove expressions like "some have argued", "GHG do harm", this is not appropriate language in a scientific assessment. What is "Pareto-irrelevant"?	Accepted - text revised.
30723	TS	59	4	59	7	The supporting text on lines 5-7 does not seem to relate to the bold finding on lines 4-5. Lines 4-5 refer to subsidies, whereas lines 5-7 discuss taxation practices. Recommend adding some text to support the result about subsidies.	Accepted - text revised.
21493	TS	59	4	59	8	This paragraph seems a bit controversial and does not account correctly of full text in 15.5: at least indicate ' Kerosene in low-income countries is in some cases an exception, with taxation being regressive'.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28925	TS	59	4			Is it possible, that elimination of subsidies of ff energy would not results in reductions of emission at negative costs? If not, than the world "can" should be replaced by "would" (and an uncertainty statement should be added).	Accepted - text revised.
28924	TS	59	4	59	8	If what is said is true "taxes are neutral or progressive" then why state the need to eliminate or reduce subsidies? The last WEO pointed out that there are a lot of countries with subsidies for fossil fuels.	Noted - text revised.
30163	TS	59	9	59	15	Negative rebound effects should be discussed at the same time as backfire, as both effects are theoretically possible (and both have limited evidence). See WGIII, Ch 9, p 41. Reference: Turner (2009). Text revision: "Macro-economic rebound effects are more uncertain and could theoretically be negative or exceed 100% (called backfire) in some cases (limited evidence, low agreement). Climate policies such as a global cap on emissions or pricing instruments could mitigate rebound effects [5.6, 9.7, 9.10, 15.5, 15.6, 15.8]"	Accepted - text revised.
21425	TS	59	25	59	38	Would enhancing public education on the impact of burning fossil fuel on the climate be considered a mitigation option, which might help to facilitate behavioural change?	Taken into account - text revised.
29762	TS	59	5	59	7	Is this true? In many cases, the rich people spend a small proportion/share of their income on energy	Taken into account - text revised.
25465	TS	6		6		Asia's current emission trajectory is similar to the one OECD countries experienced before 1970 (medium confidence)- why no "evidence"?	Rejected. It is not clear what is meant with this comment.
40885	TS	6				Reason of lower CO2 emissions from the products manufactured in developed countries (e.g., advanced industrial structure, low-carbon production processes), like those described in Chapter 5 page 42 should be described.	Noted.
22386	TS	6		6		The arrangement of the regional bars in the columns in Figure TS.3(b) should be similar to the arrangement of the regional groupings in Figure TS.3(a) - i.e. from bottom to top, they should be consistently arranged as follows - OECD90, REF, ASIA, LAM, MAF. This will allow for improved cross-figure comparison of the two figures, and would also allow for easy aggregation and comparison between Annex I (OECD90, REF) and Non-Annex I (ASIA, LAM, MAF) aggregate emissions. As it is now, the columns in Figure TS.3(b) are not consistent with the regional arrangement in Figure TS.3(a).	Noted.
21433	TS	6	1	6	7	This paragraph needs a better explanation on emissions measured as from territorial versus consumption based emissions. It should also mention that consumption-based emissions are measured, or rather estimated, with much more uncertainty than territorial ones	Accepted. We added a sentence on the uncertainties in consumption-based inventories.
39034	TS	6	1	6	26	The focus on (energy) CO2 flows and per capita framing is too heavy relative to the underlying text. Additionally, these are but two ways of viewing the discussion. It's also worth noting that such a heavy focus on primarily energy CO2 does a disservice to addressing climate change, when those emissions only account for 61% of total GHG emissions globally (see Fig. 1.3)	Accepted. We have tried to be as comprehensive as possible in the representation of greenhouse gases.
28702	TS	6	1	6	7	Para is not balanced: why is the EU singled out? The last sentence must be deleted, as it is based on the assumption that future emissions would be caused by the same countries as they are now. This is however not the case. In addition, there are several concepts of effort sharing discussed, see e.g. section TS.3.4.	Noted.
22384	TS	6	11	6	12	The references to "Annex B" should be clarified as to whether they refer to "Annex B of the Kyoto Protocol" or "Annex I of the UNFCCC"	Accepted.
19961	TS	6	12	6	12	The greenhouse gas emissions from Annex I countries are about 2.5 times as high in 2010, using the recent EDGAR data. The number 4 seems very high. The inclusion of non-CO2 gases and LULUCF sources makes a major difference in the outcome. There is no analytical basis to exclude any gases or sources, incl. LULUCF. Please check, and present the numbers including all sources and gases	Rejected. This finding is based on time series evidence from consumption-based emissions. There is not source with non-CO2 gases and LULUCF sources on this topic.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28704	TS	6	12	6	14	Fig TS.2 does not seem to provide information on a per capita basis, the reference is wrong.	Rejected. The right panel in TS.2 provides per capita information.
39036	TS	6	14	6	26	"A growing number of developing countries show per capita CO2 emissions in the range of industrialised countries from a territorial and consumption perspective." Where is the exact reference?	Accpeted. Reference was in chapter 13, but this part of the sentence has been removed from the finding.
39037	TS	6	17	6	26	The text says: "Asia's current emission trajectory is similar to the one OECD countries experiences before 1970." What is similar about it? Emissions have increased to a much greater level in a much shorter time in Asia than in OECD countries. OECD countries have never seen a rate of emissions growth comparable to that in Asia now.	This aspect of the finding has been removed from TS.
39038	TS	6	17	6	26	Based on the trends shown in Figure TS. 3, it looks as if Asia is experiencing a HIGHER rate of emissions growth from 1975 - 2010 than the developed world did from 1850 - 1975. Developed world (1850 - 1975) = ~+10 Gt/yr Asia (1975 - 2010) = ~+13-15 Gt/yr The difference is even more striking if we only look at the period of 1900 - 1975 for the developed world. For this period, emissions increased by ~7 - 8 Gt/yr (75 yrs to accumulate roughly half of what Asia has accumulated in 35 yrs). This comparison suggests that Asia's emissions are currently growing at a rate ~4 times the developed world experienced prior to 1975. That is hardly similar! It's much faster. Calling this "similar" does not accurately describe the scope of the problem.	This aspect of the finding has been removed from TS.
25023	TS	6	24	6	24	The sentence including 'The OECD countries contributed most to the pre-1970 emissions…' could be misleading as, consistent with data presented, OECD countries contributed most to pre-2009 emissions of CO2 (i.e. 61.9% vs. Asia's pre-2009 contribution of 19.2%). Suggest that this is amended to reflect the data.	This aspect of the finding has been removed from TS.
22385	TS	6	24	6	26	The statement should present a complete accurate picture of the situation as presented in Figure SPM.3, by rewording it as follows: "The 1990 OECD countries contributed most to the pre-1970 emissions and since then have continued to contribute a significant share of global emissions (approximately 12-15 GTCO2e GHG emissions per year), even as, since 1970, developing countries' share of global emissions in both absolute and percentage terms have risen over time to constitute a major share of global emissions."	This aspect of the finding has been removed from TS.
28705	TS	6	26			The sequence of the regions should be the same in a) and b), i.e. exchange orange and green.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39039	TS	6	27			The authors should review our comments on historic responsibility in Ch 3 and 5, as well. There are several problems with this figure. It needs to be heavily revised or removed from the TS altogether. (1) It is very misleading to show these as percentages since in the TS (p. 4, line 14-15) it states that "at current levels, every 12 years an amount of FF CO2 is emitted comparable to the total cumulative emissions before 1970". Heavy revision - if not total exclusion - of this figure is warranted. (2) this only shows the emissions of energy CO2, 60% of total GHG emissions; the MATCH database (www.match-info.net) and associated references (such as Hohne et al., Climatic Change, 2011: DOI 10.1007/s10584-010-9930-6) are much better resources as they include CO2, CH4 and N2O from all major sectors for all nations from 1750-2100. Additionally, literature such as Pongratz & Caldeira (Environ. Res. Lett., 2012: doi:10.1088/1748-9326/7/3/034001) illustrate how historic LULUCF emissions are significant and should not be ignored in discussions of historic responsibility, (3) Also, why the compeltely arbitrary 1970 cut-off? Perhaps of more relevance would be a 1990(ish) cut-off when the UNFCCC came into being. Analysis from the MATCH dataset (which includes all sectors and not just CO2, but also CH4 and N2O) shows that whether from 1751 or 1900 through 2010, cumulative emissions from Annex I and non-Annex I nations were 56% and 44%, respectively. If retained, the panel on the right also suffers from (1), but also is misleading and should be shown in absolute numbers, not percentages as it will likely lead the common policymaker to make inaccurate conclusions.	Accepted. We have added CO2 emissions from land-use change. Without a climate model it seems inappropriate to include non-CO2 gases.
28706	TS	6	27	6	27	Figure TS.3 (b): please add vertical axis title "Cumulative Percent of CO2"	Noted.
28703	TS	6	3	6	4	Annex B or non-Annex B is not an appropriate distinction, as the degree of industrialization is not reflected anymore for all countries. In addition, this distinction is not used in Fig 1,2,3.	Accepted. We changed to Annex I of UNFCCC.
39035	TS	6	4	6	7	It seems to be more straightforward to state "Carbon intensity in the production of goods and services is higher in developing countries than in developed countries."	Rejected. This is not the focus of the finding and the underlying literature.
29108	TS	6	4	6	6	Sentence is grammatically incorrect and needs rephrasing.	Noted.
30687	TS	6	8	6	16	In general, the text in this paragraph is not well supported by the referenced Figure (Fig TS.2) because the text refers to developing and developed countries whereas the Figure divides the world into 5 regions. This makes it very difficult to link statements to evidence in the Figure. Is the reader to assume that developed countries are represented only by the OECD 1990 countries?	Accepted.
30686	TS	6	8	6	9	Suggest adding the word "now" after "developing countries", or provide a date from which this statement is true.	Noted.
29109	TS	6	8	6	9	Please clarify whether we are talking about developing countries "taken together" or "individually" have higher emissions than developed countries.	Accepted.
21415	TS	6		6		Figure TS.3(b) shows 1750-1970, which is inconsistent with the caption.	Accepted.
21414	TS	6	8	6	16	Suggest including a brief description of the difference between "territorial CO2 emission" and "consumption-based CO2 emission" to help readers appreciate what the corresponding figure is illustrating. The paragraph discusses CO2 emissions by developing and developed countries, but the corresponding figure (TS.2) shows 4 other categories. Suggest aligning the text and the figure.	Accepted. This is included in the key finding now.
23028	TS	6	8	6	9	This statement needs clarification with a mention of the specific developing countries where emissions are higher than those of the developed countries instead of a generation for all developing countries.	Accepted. There is currently a discrepancy between the regional aggregation in the finding and in the figure.
26291	TS	6	5	6	7	The sentence: "CO2 emissions released across the global supply chain in the production of goods and services consumed in developed countries are often higher than their territorial emissions." does not match with the figure TS.2. If the sentence is valid, the red area in figure TS.2 a) should be bigger than the area below the OECD 90 dotted lines. This area is around 11 Gtons and the red area is about 1 to 2 Gtons.	Rejected.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29752	TS	6	22	6	23	'experience' and 'experienced', repetition	Noted.
32467	TS	63				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	Unclear to what the comment is refering to.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32468	TS	65				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	Duplicate comment

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32469	TS	68		69		The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	Duplicate comment
30689	TS	7				Suggest giving all the EU countries the same colour, in order to help the reader match the text on page 6 lines 9-13, with the results in this Figure	Noted.
22826	TS	7				quite interesting that a robust finding is that US and CHN together have emitted about 45%, regardless of the metric.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22387	TS	7		7		The visual arrangement of the columns creates the visual impression that all three columns represent a temporal continuum in which one sees the shares of global emissions for some countries are rising while that of other countries are decreasing, when in fact, the middle and right columns are variations of how 2010 emissions can be allocated to countries depending on whether consumption or production-based emissions are reflected. A more accurate graphic would be to have the 1751-2009 column as is, create a new "Production 2010" column beside it whose height is to scale relative to the 1751-2009 column (i.e. it would be shorter) and then this shorter "Production 2010" column could then be connected to another graphic that shows country shares of 2010 production-based emissions. The same treatment could also be provided for the "Consumption 2010" column. See, e.g., attached "Rearrangement of Figure 1.7A"	Noted.
40886	TS	7	1	7	19	About the figure TS.4 of cumulative emmisions of greenhouse gases, Match Project presented datasets of CO2 including LUCF, CH4 and N2O(Höhne et al., 2011). As it has already been written in the text, CO2 including LUCF, CH4 and N2O have some uncertainty, but the cause of global warming is not limited to CO2 from fossil fuel. So, the outcome of match project which include LUCF, CH4 and N2O should be mentioned additionally in the figure as well, describing about the uncertainty of these data, which is more objective. Reference Höhne N., H. Blum, J. Fuglestvedt, R.B. Skeie, A. Kurosawa, G. Hu, J. Lowe, L. Gohar, B. Matthews, 7 A.C. Nioac de Salles, and C. Ellermann (2011). Contributions of Individual Countries' Emissions to Climate Change and Their Uncertainty. Climatic Change 106, 359–391. (DOI: 10.1007/s10584-010-9 9930-6).	Accepted. We have added CO2 emissions from land-use change. Without a climate model it seems inappropriate to include non-CO2 gases for calculations of GHG emissions over such long time horizons.
28707	TS	7	10	7	11	Please insert "uncertainty" to increase clarity: "..individual national total fossil-fuel CO2 emissions uncertainty ranging from"	Noted. This finding has been re-written.
40887	TS	7	11	7	13	LULUCF related CO2 emissions, …. emissions are excluded. is not a representative summary of the corresponding paragraph in Chapter 1 (page 19, lines 30-42), and should be replaced with "The uncertainty range in global total emissions was estimated at +-5% excluding LULUCF and +-10% including them." (same as page 19, lines 39-40)	Noted.
29112	TS	7	14	7	14	Are the uncertaintity estimates here directly comparable with the 95% confidence interval that precedes them? Could it be clarified, as they are described differently to the other figures.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39041	TS	7	15			The authors should review our comments on historic responsibility in Ch 3 and 5, as well. There are several problems with this figure. It needs to be heavily revised or removed from the TS altogether. (1) It is very misleading to show these as percentages since in the TS (p. 4, line 14-15) it states that "at current levels, every 12 years an amount of FF CO2 is emitted comparable to the total cumulative emissions before 1970". Heavy revision - if not total exclusion - of this figure is warranted. (2) this only shows the import/export of energy CO2, 60% of total GHG emissions; the MATCH database (www.match-info.net) and associated references (such as Hohne et al., Climatic Change, 2011: DOI 10.1007/s10584-010-9930-6) are much better resources as they include CO2, CH4 and N2O from all major sectors for all nations from 1750-2100. Additionally, literature such as Pongratz & Caldeira (Environ. Res. Lett., 2012: doi:10.1088/1748-9326/7/3/034001) illustrate how historic LULUCF emissions are significant and should not be ignored in discussions of historic responsibility (3) The y-axis should not be in units of CO2e when all this is showing is energy CO2. It should be in units of CO2; (4) if retained, this should be shown in absolute numbers, not percentages as it will likely lead the common policymaker to make inaccurate conclusions, and 53) goods are sold on a global market where they are sold on a supply chain that implicitly assigns a lifecycle value (whether fully accurate or not) to that product, so any cost of carbon could be embedded in that product if the producer chose to include it."	Accepted. The figure has been revised to include CO2 emissions from land-use change. Note that non-CO2 GHG emissions are excluded due to the shorter lifetime of these gases. It seemed inappropriate to the authors to use a metric such as GWP-100 over such long time horizons. It was also considered inappropriate to build a summary finding in TS on findings on contributions to temperature changes based on two simple climate models from a single publication. Moreover, this information was not available until 2010 and would leave out a considerable share of cumulative emissions due to the high and fast growing GHG emission levels and trends.
40888	TS	7	15			Y axis is cumulative percent of "CO2e", but it should be "CO2" as it is supposed to indicate global anthropogenic Co2 emissions, not GHGs. The same problems in SPM (Figure SPM.4) and Ch.1 (Figure 1.7(a)).	Accepted.
28708	TS	7	15	7	15	Please check the vertical axis title, because the title says CO2e, but the description only mentions CO2. "Deu" should be changed to "Ger".	Accepted.
30688	TS	7	2	7	7	There is inconsistency between the reference to 70% of global CO2 emissions in this text, and in Figure TS.4, where a line marking 75% of global CO2 emissions is given.	Noted.
29110	TS	7	2	7	4	The sentence is incorrect, given that the EU countries are not treated as a single block (as stated) in Figure TS.4. The only reason here for putting EU countries together and considering them as one appears to be to produce convienient number in the preceding sentence. Politically you may want to either rephrase the "treated as a single country" phrase or consider excluding the reference to the EU here.	Noted.
21434	TS	7	20	7	20	The title does not accurately reflect the content of this box. The implications of metric choice for mitigation strategy has not yet been established and in fact it says on p.8, l.35 that choice of metric does not affect global mitigation costs.	Accepted. The title of the box has been revised.
28709	TS	7	20	8	40	Box TS.2: The title is promising, but in its current form the box might be understandable for experts, but it is not useful for policy makers - who however need this relevant information. Please simplify language. Please present the different principles of metrics, and their main weaknesses, in a balanced way using neutral language. Use the definitions from WGI for the physical metrics (GWP, GTP). Do not discuss methane, this is a policy-relevant topic under UNFCCC, but this should not the subject of this Box. The last para is very useful.	Taken into account - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26005	TS	7	21	8	6	Comment: The summary could give an example of the difference between short & long lived GHG. This to show the simplification of the commonly used 100 year factor and give an alternative view of mitigation priority and total costs applied on GHG's with different life times during other (than 100y) time perspectives. Please take in consideration this example for long lived non CO2 GHG. After have been emitted during a short period of time and then not used longer, GHG like SF6 and several of the PFC's are very long lived and will give added warm up for many thousands of years To set a global goal to halt the total radiated force in the atmosphere at a certain limit, a lower allowed total net emission load of GHG each year may be the result in the long (+ 100 y) perspective. The very long lived GHG will give a "base" load that restricts further new emissions. To compare this with a faster phase out and mitigation of the long lived non GHG may give a result in substantial added costs each year for many thousand year, especially if the marginal mitigation cost for GHG is high. The long term cost impact for emitting these gases now could be far higher than the cost we see to mitigate or replace in near future based on the 100y perspective. Comment: Methanes as both non CO2 and CO2 related GHG. 1) Methane is relatively short lived (< 50% remaining in < 10y) with a significant short term radiative force, 72 times the CO2 per ton in a 20y perspective. 2) A direct emission of Methane will in a longer perspective be converted to CO2 and influencing the radiative force as CO2. About 2,75 tons CO2 are created for each ton CH4. 3) In a shorter perspective mitigation of Methane speeds up the conversion to CO2 and reduces the near (short) term radiative force and also adds positive health effects. 4) In a longer perspective Methane mitigation is not influencing CO2 effect from its own oxidation. 5) Methane mitigation with energy production, instead of for example flaring or venting (fossil fuel handling, landfills, water treatment and VAM) have the potential of both reducing short term radiative force, health issues and replace fossil fuel usage for electricity and heat production. 6) The methane emissions radiative force from coal mined and used for energy in the near term perspective can be considerable and if CCS technology is applied it may be the main remaining contributor of near term radiative force from coal use. The example below for Hard coal mining emissions of Methane may generate GHG values of several % of final CO2 from combustion considering <100 y perspectives.	Noted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26006	TS	7	21	8	6	Example: If CH4 emissions from a Coal mining activity is 10 m3 CH4 / ton coal. The 10 m3 CH4 represents about 7 kg CH4 . This gives 7 x 72 = appr. 500 kg CO2 equiv. in a 20 year perspective. One to of Coal (anthracite) gives about 3500 kg of CO2. Result: The 20 year influence of CH4 is 500/3500 or approx. 15% of the CO2 going out from combustion of the Coal. Sources: [1] [2] Methane is relatively short lived. After 20 years an “instant” emission of 10 tons anthropogenic Methane is supposed to naturally be reduced to about 2 tons Methane and 22 tons of CO2. Eventually all Methane will be converted to CO2 with enhanced oxidation or not. The consumed Methane gives 2,75 times the weight in CO2 that decays or builds up like any CO2. So reductions in Methane emissions has a fast effect on radiative force. Anthropogenic methane is much tied to fossil fuel “production” and handling. In the time perspective of phasing out fossil fuels in < 100y the direct GHG effect of Methane will be higher than the nominal 100y value. For example in a 20 year perspective Methane is a factor 72 higher GHG effect than CO2. [1] Note: Gassy mines can give twice or more CH4 per ton coal. This giving a GHG effect from coal and CH4 total as the primary coal combustion adding 30% for the Methane in 20 years. In a 100 year perspective the added effect of CH4 will be about a third of the 20 year perspective (GHG factor 25 instead of 72). The loss of Methane is also a loss of energy. Use of the methane for medium scale energy production can replace (even if a minor fraction) electricity generated from coal (CCS for example will requires added energy production). This also with the benefit of reducing short term (<100y) GHG effect. Sources: [1] [2] 1) Global anthropogenic methane emissions 2005-2030: technical mitigation potentials and costs L. Höglund-Isaksson International Institute for Applied Systems Analysis, Laxenburg, Austria Correspondence to: L. H¨oglund-Isaksson (hoglund@iiasa.ac.at) Received: 10 February 2012 – Published in Atmos. Chem. Phys. Discuss.: 3 May 2012 Revised: 4 September 2012 – Accepted: 5 September 201. Published: 4 October 2012 2) Supplementary material to: Global anthropogenic methane emissions 2005-2030:	Noted - text revised.
28710	TS	7	21	7	21	Box TS.2: Insert "For example, per molecule in the atmosphere..."	Noted - text revised.
28711	TS	7	22	7	22	Box TS.2: The statement "methane is a more potent GHG than CO2" is misleading as it stands. Please replace by "methane has a stronger instantaneous radiative forcing than CO2".	Accepted - text revised.
21435	TS	7	23	8	1	This statement (that short-lived forcers "are likely less consequential") is not entirely accurate and badly phrased. Please rephrase using lines from WGI on this issue.	Accepted - text revised.
28712	TS	7	23	8	1	Box TS.2: Is the statement on stronger effects of later emissions true? It needs at least a reference.	Accepted - text revised.
34722	TS	7	5	7	7	The sentence, suggesting that mitigation effort may be concentrated in ten countries, could merit from a better formulation, that would be less disengaging for the rest of the countries. For example: "This suggests that while all countries have important roles to play in climate change mitigation, the efforts of these few countries are of particular importance for achieving mitigation goals."	Accepted. The finding has been revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
39040	TS	7	5	7	7	It might be worth inserting a comment at the end of this statement indicating that this is why (action within) the MEF (Major Economies Forum) is so important.	Noted.
29111	TS	7	8	7	14	Presumably the uncertainty of historical emissions also changes with time i.e. modern methodologies provide improved estimates of historical emissions.	Noted. Of course, historic emission estimates reaching a long way back have higher uncertainties attached.
32387	TS	7	20	8	40	Please make sure that the descriptions of the different concepts on GHG metrics are consisten with what is presented in WGI Ch08, section 8.7.	Noted - text revised.
21416	TS	7	11	7	11	Suggest providing the full name of LULUCF.	Noted.
29753	TS	7	8	7	14	The uncertainty levels are sometimes expressed as ±5%, ±10%, sometimes as within 25%, 30%. How do they relate to each other? Please either explain or use the same format to avoid confusion	Accepted - text revised.
21062	TS	74				Technical summary, page 42: AFOLU emissions are given as lower than in Chapter 5, page 4	Accepted, these discrepancies are being corrected.
21064	TS	74				Please rework this figure. Giving all studies / sources makes the overview difficult. Collate information to one e.g. boxplot / cost level.	Noted. Reworking the figure was considered, but ox plot cannot be used as the studies are too heterogeneous (see figure caption for details)
21063	TS	74	11	74	19	TS, page 42: You neglect indirect fossil-fuel replacements by material substitution due to use of biomass instead of other, more fossil-fuel intensive materials. Please correct this.	Accepted - text has been rewritten.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32470	TS	75				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	Duplicate comment
21437	TS	8	12	8	13	Better to say: "The choice of a 100-year time horizon is a value judgment and not based on scientific analysis".	Accepted - text revised.
23801	TS	8	15		19	Total anthropogenic ghg emissions in 2010 were 50.1 billion ton. But in this Figure it is shown as 31.9 billion ton. Is there some mistake here?	Rejected. This CO2 emissions from fossil fuel combustion and industrial processes only. The labelling of the y-axis is wrong.
21438	TS	8	15	8	15	Replace "short-lived gases" with "short-lived climate forcers" or similar as GWP is also applied to aerosols and contrails.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26007	TS	8	15	8	18	Error in writing ? Mixed up 100y value is normally around 25 and 20 year value 70 to 80 (82). Quote: The choice of time horizon is particularly important for short-lived gases, notably methane: when computed with a shorter time horizon their share in calculated total warming effect is larger [1.2.1.5].For example, the GWP for methane with a 100-year horizon is 82; with an horizon of 20 years, the GWP drops to 28 [3.11].	Accepted - text revised.
28714	TS	8	15			Box TS.2: Why is methane (the most persisting of the short lived species) given as an example? The difference between GWPs for different time horizons should be even larger for species with an even shorter life time in the atmosphere, i.e. black carbon or ozone.	Accepted - text revised.
28715	TS	8	15	8	15	Box TS.2:delete "short-lived gases, notably" an insert "for instance". The definition of short-lived (days to decades) is too vague. The problem of the choice of the time horizon becomes clear without using this term.J1067	Accepted - text revised.
19634	TS	8	15	8	18	These two sentences seem inconsistent.	Noted - text revised.
31363	TS	8	17	8	18	Please correct the numbers for the GWP for methane. For the 100-year horizon and 20-years. In addition the chapter reference in this sentence (3.11) seems incorrect since it refers to "Gaps of knowledge and data".	Accepted - text revised.
30690	TS	8	17	8	18	The values given for the GWP for methane over 100 years and 20 years are reversed; the value should be larger for the shorter time horizon.	Accepted - text revised.
25024	TS	8	17	8	19	The GWP values for 20 and 10 years for CH4 seem to be reversed- suggest amending.	Accepted - text revised.
23156	TS	8	17			Because of methane's short residence time its GWP with a 100 year horizon is less than with a 20 year horizon. Text has this backward.	Accepted - text revised.
27336	TS	8	17		18	With regard to the Technical Summary, there is a serious mistake on page 8, lines 17-18. The comment on GWP of methane is wrongly stated as follows: "…For example, the GWP for methane with a 100-year horizon is 82; with an horizon of 20 years, the GWP drops to 28 [3.11]." In fact, GWP for methane with a 100-yr horizon is 25, and raises to 72 with a horizon of 20 yr (see IPCC, 2007 – cited as Forster et al. 2007). Reference: FORSTER, P., RAMASWAMY, V., ARTAXO, P., BERNTSEN, T., BETTS, R., FAHEY, D.W., HAYWOOD, J., LEAN, J., LOWE, D.C., MYHRE, G., NGANGA, J., PRINN, R., RAGA, G., SCHULZ, M., VAN DORLAND, R. Changes in atmospheric constituents and in radioactive forcing. In: Climate Change 2007: The Physical Science Bases. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Avert, M. Ignorant H.L. Miller (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 2007.	Accepted - text revised.
27323	TS	8	17	8	18	The comment about GWP of methane is erroneously stated: "...For example, the GWP for methane with a 100-year horizon is 82, with an horizon of 20 years, the GWP drops to 18 [3:11]." In fact, the GWP for methane with a 100-year horizon is 25, and increases to 72, with a 20-year horizon. (See IPCC, 2007. Referred to as Forster et al., 2007)	Accepted - text revised.
22417	TS	8	17	8	18	I suppose GWP for methane with a 100-year horizon is "28" instead of "82" and that with a 20-year horizon is "82" instead of "28".	Accepted - text revised.
39042	TS	8	17	8	18	This statement is backwards - The 100 year horizon is 28 and the 20 year horizon is 82.	Accepted - text revised.
40889	TS	8	17	8	18	The GWP value of methane should be 28(100y) and 82(20y)… usually longer year gives smaller GWP.	Accepted - text revised.
28716	TS	8	17	8	18	Box TS.2: Error in the GWPs of methane: the GWP with a 20-year horizon must be higher than the GWP with a 100-year horizon.	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30691	TS	8	18	8	20	All 4 of these metrics are identified as physical metrics, whereas in the following paragraph, global damage potential is referred to as an economic metric. Clarification/explanation is required here. Also, it would be helpful if, at the end of line 18, references to places in the report where these metrics are evaluated, could be added.	Noted - text revised.
28717	TS	8	18	8	20	Box TS.2: GDP and GCP are no physical metrics, please correct. Please explain why it is important to know that these other metrics exist or delete sentence. These metrics are not "available", but "discussed". The current wording suggests, that there are several useful and robust metrics at hand - which is not the case as they all have their flaws.	Accepted - text revised.
28718	TS	8	20	8	23	Box TS.2: Please delete " the most appropriate metric". This is policy-prescriptive, even with the qualifier "conceptually". For example your statement only mentions economics, but how about biodiversity, eco system services or damages to nature?	Accepted - text revised.
21439	TS	8	24			Comprehensive economic metrics such as the global damage potential may be measured as for example the equivalent change	Noted - text revised.
28719	TS	8	28			Box TS.2: GWP is not "uncertain" in terms of damages, it is just "not addressing" them. Please correct.	Accepted - text revised.
30692	TS	8	33	8	34	Suggest the last sentence of this paragraph could be deleted as the point that choosing a time horizon for the metric affects the share attributed to methane is already covered on lines 15-20.	Accepted - text revised.
28720	TS	8	33	8	34	Box TS.2: Please delete last sentence of the para, it does not add new information, and it not appropriate in this Box on concepts of metrics. The choice of metrics for methane is scientifically not more difficult than for any other species. However, it is difficult for policy makers and negotiators of the UNFCCC, as it has significant financial implications - not the topic of IPCC.	Accepted - text revised.
21440	TS	8	34			reference could be made here to the difference between the cost-benefit analysis, with damage valuation and the cost-effectiveness approach which aims at a least cost solution for a given target	Noted - text revised.
21441	TS	8	34	8	34	Why single out CH4 here? It's slightly misleading as this statement applies to all short-lived climate forcers.	Accepted - text revised.
30693	TS	8	35	8	40	This paragraph is not clear. In particular, while the first and third sentence stress the importance of choice of metric, the second sentence refers to changes in GWP values, so the link to the issue of metrics is not clear. Also, if this second sentence is retained, the changing GWP values from the 2nd to 4th Assessment should be provided otherwise most readers will not know what these were.	Accepted - text revised.
28721	TS	8	35	8	40	Box TS.2: Reference in bracket to sec. 4.2: It is not clear what within this paragraph is related to sec. 4.2 in Ch. 3. Maybe wrong reference?	Accepted - text revised.
21442	TS	8	39			"Impacts on economic cost will generally depend on the regional share of CH4 emissions. [6.3.4.2]" : need further clarification	Noted - text revised.
31165	TS	8	4	8	4	"could" should be "can"	Accepted - text revised.
39043	TS	8	44	8	45	At the beginning of section TS.2.2 this statement is made: "...but other innovations improve labour productivity and increase emissions." Is this meant to imply that improved labour productivity always increases emissions. If so, could you provide more discussion about this effect. If not, perhaps the sentence could be reworded for clarity.	Noted.
30694	TS	8	47	8	47	The term "rebound effect" should be defined. If it is defined in the Glossary, then that may suffice.	Accepted. Rebound effect is defined in the glossary
21443	TS	8	47			"rebound effect in energy consumption"	Noted.
28722	TS	8	47			Box TS.2: Please explain "rebound effect" in glossary. Suggestion to use the expression "lock in effect" in this box.	Accepted.
21436	TS	8	6	8	6	What is meant by differential costs? Notion differential is not clear. Do you mean marginal costs?	Accepted - text revised.
28713	TS	8	7			Box TS.2: This definition sounds complicated and is not exact (there are integrated and instantaneous metrics). Please use the definition from WGI. "accumulated" is not the appropriate expression, please use "integrated over time". Does WGI call it an "outcome metric? Please be consistent.	Accepted - text revised.
21417	TS	8	17	8	18	The statement is inconsistent with line 11 on P. 85 of Chapter 3	Accepted - text revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20029	TS	8	17		18	Check the numbers of GWPs for methane.	Accepted - text revised.
25430	TS	8	47	8	47	May help to expand on "rebound effect," may not be apparent to all readers.	Taken into account - box on rebound effect was added.
34039	TS	8	17	8	18	The reference to 3.11 does not seem accurate as there is no mention of methane and its GWP at different time scales in that section, much less an explanation in this regard.	Accepted - text revised.
34040	TS	8	35	8	40	This paragraph is unclear and the reference to [6.3.4.2] appears to be inappropriate as it is entitled "Energy end use sectors along transformation pathways" and there is no mention of methane/CH4 in that section.	Accepted - text revised.
28724	TS	9	12	9	15	Box TS.2: It would improve clarity to separate the mitigating factor (solely the 24% decrease in energy intensity on the downward side) from the aggravating factors (increase in CO2 intensity in energy resources, increase in GDP/cap and increase in population).	Unclear to what the comment is refering to.
23802	TS	9	13		14	While it is a fact that there is no conclusive scientific evidence in favour of 100 year time horizon, it is misleading to call it a value based assumption. This is an assumption based partly on the hard scientific evidence of chemical half life for non-CO2 gases, partly on time estimates of the various ways in which a CO2 molecule in the atmosphere would dissipate. I would prefer to call it a well reasoned assumption.	Taken into account - text revised.
28725	TS	9	14	9	15	Box TS.2: 2 changes to clarify the sentence: "..a modest 4% increase in CO2 intensity of energy resources, 24% decrease in energy intensity per unit of GDP"	Noted.
28726	TS	9	14	9	16	Box TS.2: Carbon intensity = CO2 intensity?	Noted.
20829	TS	9	18	9	20	The carbon intensity of energy of highly industrialized world owes to not only natural gas and renewables but also nuclear energy. "to natural gas and also to renewables" should be amended into "to natural gas, renewables and also to nuclear".	Accepted. Either this is a comprehensive for list for all low carbon fuels or the statement is more general. The latter approach has been implemented in the new version.
25599	TS	9	18	9	20	See comment No.1.	Rejected. It is unclear what is meant here. Comments need to be self-contained. Due to the large amount of comments received it is impossible to trace across comments. However, we will have answered the comment referred to and implemented changes, if necessary.
25650	TS	9	18	9	20	This part should explain that nuclear power has contributed largely to reduce CO2 emission in the world and has a merit to reduce CO2 emission more economically than renewable energy, as described in the section 7.5.4 (page 28, line22) and (Weisser, 2007, page1). This literature is listed in the No2 line of this table.	Rejected. This section is trying to understand dirvers of emission reductions. But the statement has changed not to refer selectively to some lower carbon fuels compared to coal and not others.
29113	TS	9	28	9	29	It would be helpful to clarify that percentages quoted are annual increases and not percentages of consumption based emissions.	Noted.
31166	TS	9	33	9	33	"metabolic rates" not defined, and will not be known to all reader audiences. Would be more informative- and really get the core of message across- to talk about resource usage (amount and efficiency) instead. Better to not use metabolism.	Noted. This paragraph has been removed from the new TS.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21444	TS	9	6	9	8	This sentence is not clear. What does "the context in which decisions are made" mean?	Accepted. This sentence has been changed to become clearer and more factual.
22827	TS	9	6		8	this sentence is not clear. What does "the context in which decisions are made" mean?	Accepted. This sentence has been changed to become clearer and more factual.
28723	TS	9	9	9	20	In order to easier understand Figure TS.5 on p. 10 it would be helpful if the colors of the different lines in the figure would be related to the explanation in the text (e.g. 24% decrease in energy intensity in GDP - Fig TS.5 violet line)	Noted.
21418	TS	9	33	9	33	Suggest explaining what is meant by metabolic rates.	Noted. This finding has been removed from the TS.
34041	TS	9	27	9	29	Please provide the absolute consumption emissions figures here too for 1990 and 2009. This is to be able to note the differences in consumption emissons in 1990 that might somewhat explain the greater rate of increase in China. Additionally, translating these figures to a per capita basis (absolute and then the rate of change) will also provide additional information to form a more accurate impression of the situation for the reader.	Noted. This finding has been removed from the TS.
23768	TS	all				no feedback mechanisms are mentioned - and yet, this is clarly the one process that undermines the entire proposition behind AR5	Rejected. It is not clear what is meant. The comment seems incomplete.
27283	TS	TS				Figure SPM.1 represents change in global anthropogenic GHG emissions by major economic regions. Economic regions represented in the figure relate to G-20 membership, which is inadequade, since it does not correspond to a relevant grouping in the context of climate change, as it is based solely on economic factors. It is noted that the text following the table adequately presents trends based on groupings that are traditionally used in the international climate change context (Kyoto Protocol Annex B and non-Annex B Parties). Social development figures (such as per capita income and HDI, and others) must also be used as basis for comparison in the consideration of trends by the IPCC.	Rejected. Groupings need to be relevant for the subject under consideration. It was decided by the author team to choose country groupings depending on the question under consideration.